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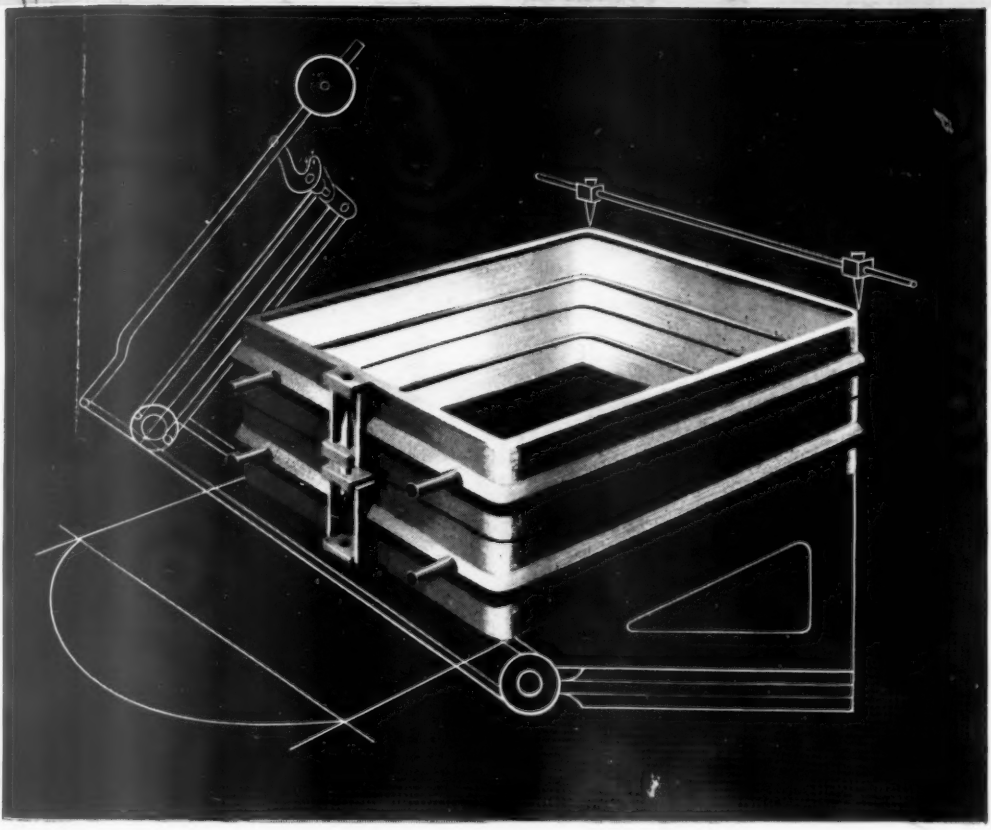

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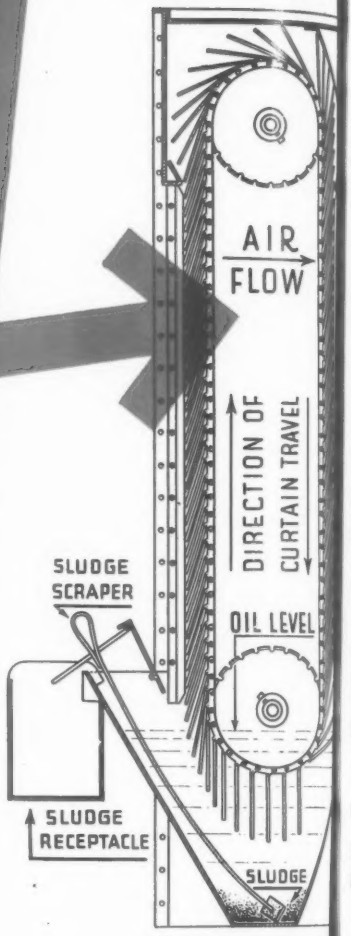

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The Worshipful Company of Founders

The Worshipful Company of Founders is probably the oldest organization in the world to be associated with the manufacture of cast products, though in France, the *Syndicat des Fondeurs* is the direct descendant of the *Corporation des Fondeurs,* which also had its origin in the mediæval guilds. When it was formed, at some time earlier than 1365, the main object of the Founders Company was quality control, and its establishment was probably due to the unwillingness of the staff of the foundries operated in the monasteries of the period to produce pots, pans, and similar productions for commercial and domestic use, as distinct from ornamental castings. The moulders among the monks were also jewellers, and made altar furniture, *chefs* (boxes for containing holy relics) and religious ornaments. Such craftsmen obviously preferred this type of work to repetition jobs. In those days, of course, cast iron was virtually unknown in this country.

With the passing of the centuries, the character of the Founders' Company underwent many vicissitudes of fortune, and by late Victorian days, the Livery, like most other Guilds, was mainly made up of gentlemen who actively associated themselves with the affairs of the City of London and its charities. The Founders' Company, however, never lost interest in the crafts they represented. Just before the 1914 war, for example, it organized an exhibition and competition with the object of advancing the technology of the foundry industry.

About 20 years ago, the first of the modern generation of founders entered the Livery. To-day, no fewer than a quarter of the Liverymen are actively engaged in the foundry industry in executive positions, and with every passing year, the ties with the industry have become strengthened. Each year, Liverymen of the Company make a tour of foundries in different areas and acquire first-hand knowledge of the industry's aspirations and progress. The Company has helped practising foundrymen in many ways, in particular in the supply of future technologists by the granting of scholarships enabling the recipients to travel abroad or study in an appropriate college. Yet so far as customs and ritual are concerned, it zealously honours those procedures which have been passed down through the ages. It still possesses equipment for "size and stamping" nests of weights, a duty now undertaken by the Board of Trade. A beautiful Venetian glass goblet (a prize possession of the Company dating from 1527) is still used—filled with hippocras—by the retiring master, when presenting his successor to this high office. The foundry industry is indeed proud of this most ancient of its organizations.

Foundry Trades Equipment and Supplies Association

The annual general meeting of the Foundry Trades' Equipment and Supplies Association was held at the Waldorf Hotel, London, on October 15, when the following report of the year's activities up to December 31, 1956, was presented.

Membership

During the year under review three new members were elected and there were three resignations; thus the total of 70 members remained unchanged since the previous year. During the last six years membership has increased by over 40 per cent. and it is hoped that this trend will continue as the Association can do much for the benefit of members and the foundry industry.

Accounts

The accounts of the Association for the year ended December 31, 1956, showed an excess of expenditure over income amounting to £82 17s. 10d. The subscription of 10 guineas paid by each member during the year under review, was originally fixed by the Council in 1950. During the intervening years administration expenses have steadily increased with rising costs and, in reviewing the matter, the Council was compelled to increase individual subscriptions in respect of the year 1957.

Council

The Council held eight meetings during the year and the various matters of interest to members have been circularized. Grateful acknowledgment and appreciation is extended to those members of the Association whose services have been given freely throughout the year for the benefit of the Association.

Handbook

The committee, under the chairmanship of Mr. W. Rawlinson, held several meetings in connection with the preparation of the third edition of the "British Foundry Plant & Supplies Handbook." It is pleasing to note that more members have taken advantage of the opportunity to advertise in the new publication and every effort has been made by the handbook committee to produce a useful and informative book for use by purchasers of foundry equipment and consumable stores.

Institute of British Foundrymen

Members of the Association contributed a total of £221 towards the expenses of the 1956 annual conference of the Institute.

National Union of Manufacturers

The Association has continued its membership of the NUM and has given its full support on various matters which have affected members. Also, Mr. D. H. Wood has continued to serve as the Association's representative on the Executive Council.

British Standards Institution

Mr. J. G. Lowe, of Sterling Foundry Specialties, Limited, has continued to serve as the Association's representative on committee MEE/22 and a standard specification for "Wooden-pattern Equipment for Foundries"—B.S.: 467: 1957—has now been published.

National Foundry Exhibition

Following the decision at the annual general meeting held last year, the Council explored the possibility of holding such an exhibition in co-operation with other associations in the industry. Members have been informed of the developments and of the outcome of these deliberations. A decision was made at a subsequent extraordinary general meeting that the Association should proceed to organize a Foundry Exhibition in May, 1959.

In the course of the meeting, the president, Mr. G. E. Lunt (Bradley & Foster, Limited), and the vice-president, Mr. Gavin C. Paterson (Paterson, Hughes Engineering Company, Limited), were re-elected for a further term of office, as were other Members of Council.

The significant increase in membership of the Association over the last few years was reflected in attendance at the annual luncheon which preceded the meeting, the record number of 50 being present.

Forty Years Ago

The issue of the FOUNDRY TRADE JOURNAL for October 1917 carried an article, with Editorial comment, on "Dust in the Foundry," and suggests that *sand* blasters should wear respirators, and that grinding wheels should have an effective dust-exhaust system. This acts as a pointer to the great changes that have taken place since that date. Next, the Editor took up the question of fuel economy, but failed to stress the need for accurate measurement when charging furnaces. His final comment was that, in the distribution of awards of the newly-formed Order of the British Empire, founders had been quite overlooked.

There was an interesting illustrated article on the casting of an 80-ton component in iron. The difficulties to be overcome were appalling—the foundry roof was low—12 ft. between crane hook and floor level—water was found two feet below the floor, and only two 20-ton cranes were available for lifting. Thus, one side of the casting was raised and rollers placed beneath it and then the casting was skidded on rollers for some 500 ft. A paper on the "Heat-treatment of Grey Cast Iron" was included in the issue; it was by a young author (still living) who has since achieved eminence in the industry. Under "New Companies Registered" the name of Stokes Castings, Limited, and R. Lilly & Sons, Limited, appeared.

Short-paper Competition

Quite a number of entries were received for the short-paper competition for which the president of the Institute of British Foundrymen offered prizes of £10 and £5 for the two best efforts. The competition was designed to stimulate members to write short papers for publication. On the recommendation of the assessors the first prize of £10 has been awarded to Mr. D. Miller (associate) for a paper "Withdrawing an Undercut Core Automatically" and the second prize of £5 to Mr. F. D. Roper (associate member) for a paper entitled "Some Observations on Cupola Tapping." Mr. Miller, a member of the London branch of the Institute, is attached to St. Albans Die-casters, Limited, and Mr. Roper, of the Birmingham branch, is instructor at the National Foundry Craft Training Centre, West Bromwich.

DR. E. C. ELLWOOD, chief metallurgist of the Tin Research Institute, left London on Tuesday for New York to represent the Institute at the Second World Metallurgical Congress, which opens in Chicago on November 2. While in America Dr. Ellwood will visit Pittsburgh, Boston, and New York, as well as the Tin Research Institute's American office at Columbus, Ohio, to study recent American developments in the casting of bronze and research into new forms of engine bearings.

Inoculation of High-strength Grey Cast Iron*

By N. C. McClure, A. U. Khan, D. D. McGrady, and H. L. Womochel

It has been generally understood for many years that the late addition of certain silicon alloys to molten iron produces changes in the graphite distribution; improvements in the mechanical properties, and a reduction of the chilling tendency which are not explainable on the basis of composition change with respect to silicon. A large number of silicon alloys of widely different composition have been recommended as late-addition agents for "inoculants." Lownie[1] has listed twelve late-addition alloys containing silicon. He also includes the element calcium, and the element carbon in the form of graphite as inoculating agents. Silicon has been regarded as the essential and active agent in inoculating alloys. This Paper deals, in detail, with a series of experiments to determine the effect on the mechanical and physical properties of high-strength, grey cast iron, when inoculated with silicon containing alloys and other metals. The alloys and metals employed for these experiments were: Ferro-silicon; calcium-silicon; manganese/zirconium silicon and manganese silicon, with varying silicon contents, together with metallic silicon; calcium, and aluminium.

Information concerning the effectiveness of many of the inoculants is not found in the literature, and sufficient information regarding the relative effectiveness of the more generally employed alloys is not available. The impression can be gained from the literature that the various alloys are about equivalent to one another in their effectiveness. The amount of data on the quantity of the various alloys necessary to effect the desirable type "A" or random graphite distribution and maximum properties is limited.

Many theories for the mechanism of inoculation have been advanced. Most of the explanations have been based on a nucleation mechanism and it has been proposed that particles of silica, silicates, or graphite nucleate the solidification and thereby influence graphite distribution. Other theories propose that gas content, and surface-energy factors are involved. None of these theories seems to be capable of explaining all of the observation relating to the inoculation phenomenon.

The present writers have been of the opinion that some of the confusion is a result of lack of data on the relative effectiveness of the various inoculating alloys, which vary widely in composition. If these alloys differ in their effectiveness such data might provide valuable clues as to the nature of the inoculation mechanism in addition to furnishing information of practical value to producers of grey iron. Accordingly the writers have undertaken a number of experiments for the purpose of determining the relative effectiveness of some of the commonly employed inoculation alloys.

Experimental Procedure

All but two of the heats described in this report were made in a 250-lb., indirect-arc, rocking furnace. Charges in the cold furnace consisted of pig-iron, structural steel, ingot-iron punchings, and 27 per cent. ferro-silicon. Manganese and sulphur contents were adjusted immediately after the melt-down with additions of 80 per cent. ferro-manganese and of iron sulphide.

All melts were brought to 1,565 deg. C., as determined by optical pyrometer readings through the spout. Pouring temperatures were maintained at 1,455 deg. C.

All ladle additions, unless otherwise indicated, were made by tapping a small amount of metal into the ladle and then adding the inoculating alloys continuously as the balance of the iron entered the ladle. The time interval between tapping and pouring varied in general from 2 to 4 min.

Metal from each ladle was cast into vertical, dry-sand core, 1·2 in. dia. standard test-bar moulds, washed with a non-carbonaceous silica wash. These bars were broken on 18-in. centres in accordance with standard procedure (all transverse test-bar results are the average of three or more tests).

Small wedge chill-test specimens were used in some experiments; in others a chill block having the dimensions $\frac{1}{2}$ by $2\frac{1}{2}$ by $3\frac{7}{8}$ in. was employed.

Tensile-test results are not reported in all cases; as the work continued, it became evident that the transverse breaking-load, deflection, and in particular the triangular resilience provided a more sensitive index of variations in microstructure than did the tensile strength (triangular resilience = $\frac{\text{deflection} \times \text{transverse breaking load})}{2}$. The most potent influence of inoculants on microstructure is at the surface of the casting. This renders the transverse bar, tested in the unmachined condition, a suitable test-specimen for the purpose of demonstrating inoculation action.

In making comparisons between irons in this paper an effort has been made to keep the carbon equivalents $\frac{(C + Si)}{3}$ within one-tenth of one per cent.

Carbon and silicon contents were determined on each ladle, sulphur, manganese, and phosphorus contents being determined only on one ladle from each heat unless these elements were involved in the additions, or when there was reason to believe that their contents were altered by the ladle addition.

* Condensation of a Paper presented to the National Convention of the American Foundrymen's Society, Cincinnati, Ohio, May, 1957. The Authors are, respectively, materials engineer, Dow Chemical Company, Midland, Michigan; design engineer, Whirlpool-Seeger Corporation, St. Joseph, Michigan; assistant professor of metalurgical engineering, and associate professor of metallurgical engineering, Michigan State University.

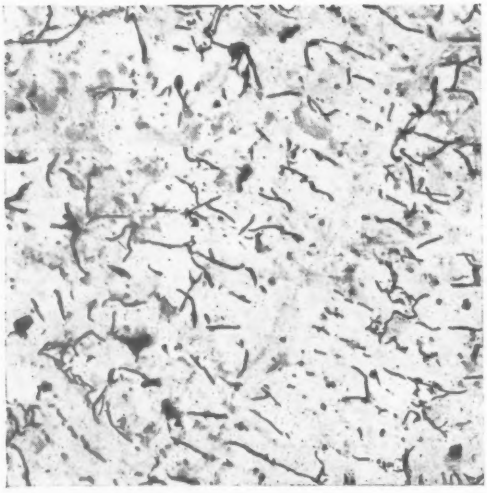


FIG. 1.—*Microstructure of interior of T2-F2 iron, treated with 0·6 per cent. Si (as ferro-silicon). (Etched nital × 100 magnification.)*

Typical microstructures are presented for the purpose of illustration and discussion. The microstructures of all significant irons were examined and it was concluded that the results of the transverse tests were well correlated with the variations in microstructure.

In making additions of the various alloys, an attempt was made to keep the crushed sizes of the alloys comparable in each case. In general, the commercial size " 8-mesh and down " was employed.

Experimental Results

Since the amount of data in this report is considerable, the results are presented as a number of separate experiments, for the convenience of the reader. Each comparison of irons is given in two tables, the first tabulating the available analytical data, and the second the mechanical properties.

Comparison of Ferro-silicon and Calcium-silicon

The two most widely employed inoculants have been ferro-silicon and calcium-silicon. In view of the industrial importance of these two alloys, ferro-silicon and calcium-silicon were selected by the writers for the initial experiments of this investigation.

Some difficulty is experienced in determining the relative amounts to be used in making a comparison between alloys as diverse in chemical analysis as are these two. The situation is rendered more difficult by the fact that the silicon pick-up is more complete when ferro-silicon is employed than is the case with calcium-silicon. It was decided that the most satisfactory basis for comparison would be afforded by the use of amounts of the alloys such that the silicon pick-up would be approximately the same in each case. This would involve using somewhat larger amounts of calcium-silicon. For the experiments performed in this investigation, this basis required using amounts of the two alloys in the proportion of 0.30 per cent. addition of Si as ferro-silicon to 0.35 per cent. addition of Si as calcium-silicon in the first comparison, and 0.60 to 0.70 per cent. in the second.

The following procedure was used. A 200-lb. heat was melted and brought to 1,565 deg. C. as described under experimental procedure. Two pairs of 50-lb. ladles were tapped from the heat. One member of the first pair (iron No. T2-F1) was inoculated with 0.30 per cent. Si addition as ferro-silicon and the second with 0.35 per cent. Si addition as calcium-silicon (T2-C1). This procedure was repeated for the second pair of the ladles using 0.60 per cent. Si as ferro-silicon (T2-F2) and 0.70 per cent. Si as calcium-silicon (T2-C2).

The composition of the ferro-silicon used was: Si 92.73; Al 1.68 and Ca 0.25 per cent. The calcium-silicon was: Si 63.97; Ca 31.72; Fe 1.70; Zr 0.08; Ti 0.16 and Al 1.09 per cent.

Chemical composition data for the irons are presented in Table I, and the mechanical properties in Table II. The manganese, phosphorus and sulphur contents were not determined on all ladles. In these tables the irons to be compared are grouped as pairs. The heading " Trans " refers to the transverse breaking load in lb. on 18-in. centres, " Deflec " to the deflection in inches, " Res " to the triangular resilience in inch-pounds. The figures under " Chill " signify the clear chill and the total chill respectively in $\frac{1}{32}$-in. units.

TABLE I.—*Data on Ferro-silicon and Calcium-silicon as Inoculants.*

Iron.	Addition.	Composition, per cent.				
		C.	Si.	Mn.	P.	S.
T2-F1	0.30 per cent. Si as FeSi	2.95	2.00	—	—	—
T2-C1	0.35 per cent. Si as CaSi	2.94	1.95	—	—	—
T2-Fe	0.60 per cent. Si as FeSi ..	2.90	2.17	—	—	0.056
T2-C2	0.70 per cent. Si as CaSi	2.84	2.21	0.99	0.102	0.046

TABLE II.—*Mechanical Properties of Various Inoculated Irons.*

Iron.	Inoc.	Trans., lb.	Deflec., in.	Res. in lb.	Tensile, tons per sq. in.	Chill*, 1/32 in.
T2-F1	FeSi	2,665	0.208	277	20.9	30 to 45
T2-C1	CaSi	3,597	0.361	651	25.6	13 to 18
T2-F2	FeSi	2,905	0.261	379	23.1	12 to 20
T2-C2	CaSi	3,728	0.394	745	25.2	4 to 8

* Figures refer to clear chill and total chill respectively.

Table II shows the marked superiority of calcium-silicon over ferro-silicon when additions were made to produce the same silicon increase. All mechanical properties are superior in the case of the irons treated with the high-calcium alloy. It is also evident that the high-calcium alloy was much more effective than the ferro-silicon in reducing chilling tendency.

Examination of the microstructure of the cross sections of the transverse bars revealed an entirely normal (type A) graphite distribution in the interior of the bars treated with the heavy addition of calcium-silicon (T2-C2). The corresponding bars (T2-F2) treated with ferro-silicon showed a tendency towards Type D and Type E graphite distribution (see Fig. 1). At the immediate surface, the calcium-silicon iron was found to have a microstructure consisting mainly of type A graphite with only a slight tendency towards D (see Fig. 2). The structure at the surface of the ferro-silicon iron was highly abnormal with considerable ferrite (Fig. 3).

In general, the microstructures of Figs. 1, 2, and 3 are typical. Incomplete inoculation manifests itself as a tendency towards types D and E graphite distribution with associated ferrite, and this tendency is shown to be particularly marked at the surface. In the succeeding experiments, microstructures will not be presented in all cases, and reference can be made to these photomicrographs as being representative. A good correlation exists between the transverse-breaking loads, deflections, triangular resilience, and the microstructure. These values will be taken as measuring the effectiveness of the various ladle treatments in subsequent experiments.

It is remarkable that this superiority of calcium-silicon over ferro-silicon has received so little attention in the literatures. This difference appears to be very significant both in a practical and a theoretical way. The superiority of the alloy containing the larger amount of active metal was indicative of an important role of the active metal in inoculation. Accordingly, a series of experiments have been carried out in which the effects of active metals have been determined.

Calcium-silicon and Silicon-manganese-zirconium Alloys

Alloys containing silicon, manganese, and zirconium are employed extensively as inoculants. Lownie[1] states that such alloys are more effective than ferro-silicon, and Burgess and Bishop[2] present data on irons treated with these alloys. However, the data on the relative effectiveness of these alloys with other inoculants are lacking.

In view of the importance of the zirconium alloys as commercial inoculants, experiments were undertaken to compare the alloy with calcium-silicon. The procedure followed was that of the previous experiment. A 200-lb. heat was divided into two pairs of ladles—the members of the first pair were inoculated with 0.30 per cent. Si as the zirconium alloy and 0.35 per cent. Si as CaSi. The members of the second pair of ladles were inoculated with 0.60 per cent. Si as zirconium alloy and 0.70 per cent. Si as CaSi respectively. The somewhat greater addition of CaSi was necessitated by the lower silicon pick-up from the latter alloy.

The chemical composition of the irons is presented in Table III, and mechanical-property data in Table IV. The composition of the alloys employed is tabulated below.

Composition, Per Cent.

	Si.	Ca.	Fe.	Zn.	Ti.	Al.	Mn.
Cu-Si	63.92	31.72	1.70	0.08	0.16	1.09	—
Zirconium alloy	62.79	2.19	—	5.45	0.19	1.50	6.45

In this and in the other cases of this report, the alloy analysis given is that supplied by the producer of the alloy. These results indicated that the zirconium alloy was inferior to Ca-Si so far as the mechanical properties were concerned when the additions were made to give approximately the same recovery of silicon. The difference in chilling tendency was not sufficient to permit a final con-

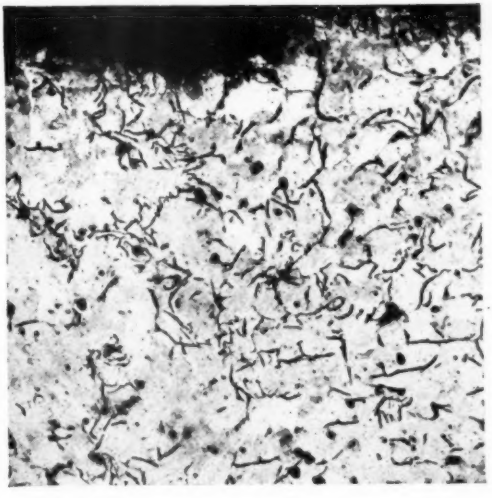
TABLE III.—*Analysis of Various Irons Treated with Calcium-Silicon and Silicon-Manganese-Zirconium.*

Iron.	Addition.	Composition, per cent.				
		C.	Si.	Mn.	P.	S.
T8-S1	0.30 per cent. Si as Si/Mn/Zr	2.80	1.97	0.94	—	—
T8-C1	0.35 per cent. Si as CaSi	2.86	1.96	0.92	—	—
T8-S2	0.60 per cent. Si as Si/Mn/Zr	2.86	2.30	0.96	—	0.056
T8-C2	0.70 per cent. Si as CaSi	2.82	2.22	0.91	0.084	0.046

TABLE IV.—*Mechanical Properties of Various Irons Inoculated with Calcium-Silicon and Silicon-Manganese-Zirconium.*

Iron.	Inoc.	Trans., lb.	Deflec., in.	Res. in lb.	Tensile, tons per sq. in.	Chill 1/32 in.
T8-S1	Si/Mn/Zr ..	3,023	0.283	430	21.4	12 to 22
T8-C1	CaSi ..	3,327	0.322	536	22.5	14 to 22
T8-S2	Si/Mn/Zr ..	3,138	0.326	511	21.8	10 to 15
T8-C2	CaSi ..	3,516	0.365	644	26.6	12 to 17

FIG. 2.—*Microstructure at the surface of T2-C2 iron, treated with 0·7 per cent. Si in the form of calcium-silicon alloy. (Etched-nital* ×100 *magnification.)*



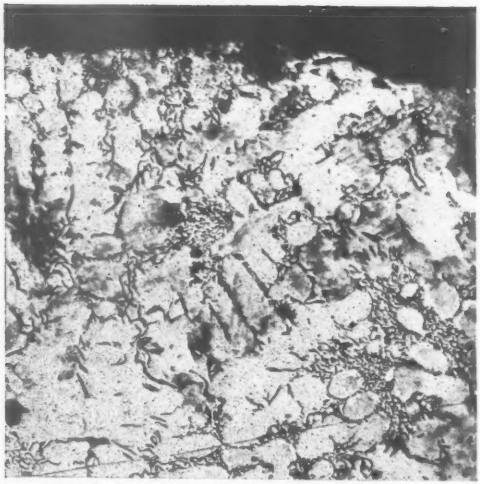


FIG. 3.—*Structure at the surface of T2-F2 iron, treated with 0·6 per cent. Si as ferro-silicon. (Etched in nital* ×100 *magnification.)*

clusion, but it was indicated that the zirconium alloy was slightly more effective than CaSi in reducing chill.

Figs. 4 and 5 show the surface microstructures of the irons treated with the smaller amounts of the two alloys. It is evident that these amounts of the alloys are not sufficient to produce normal structures at the surface of castings of 1.2-in. dia. The microstructure of the CaSi-treated iron was somewhat superior to that of the other iron.

Silicon-manganese as an Inoculant

Silicon-manganese is not commonly used as an inoculant. However, it has been listed with other inoculants and it is mentioned as an inoculating substance in the article dealing with grey cast iron in the American Society for Metals Handbook, page 515, 1948 edition. The fact that silicon-manganese/zirconium alloys are effective inoculants may be taken as an indication of some possible value in a late addition of manganese.

The following experiment was undertaken to determine the effect of silicon-manganese additions. Heat T3 was melted and ladles 1 and 2 were treated with a 1.0 per cent. addition of silicon-manganese (0.5 lb. of alloy per 50-lb. ladle). Blank heat T4 was melted with the composition of the cold charge adjusted with respect to silicon and manganese to give approximately the same final composition as for heat T3.

Results of these heats are given in Tables V and VI. The composition of the silicon-manganese employed is given as follows:—Composition of SiMn, Mn, 66.5; Si, 18.5; C, 1.25; Fe, 13.00; Ti, 0.17 per cent. with Ca and Al present only as traces. These results would be interpreted as indicating that silicon-manganese of the composition employed is not of value as an inoculant, and that the withholding of silicon and manganese from the charge for the purpose of making late additions was detrimental to the properties of the iron, including chilling tendency. It was noteworthy that the silicon-manganese employed is free of both calcium and aluminium.

TABLE V.—*Data on Silicon-Manganese and Blank Heats.*

Iron.	Addition.	Composition, per cent.				
		C.	Si.	Mn.	P.	S.
T3-1	1.0 per cent. SiMn ..	2.88	2.31	1.06	0.075	—
T4-1	Blank	2.94	2.34	0.98	—	—
T3-2	1.0 per cent. SiMn ..	2.93	2.34	1.07	—	0.060
T4-2	Blank	3.00	2.33	1.00	0.077	0.062

TABLE VI.—*Mechanical Properties of Various Irons.*

Iron.	Inoc.	Trans., lb.	Deflec., in.	Res. in. lb.	Chill 1/32 in.
T3-1	SiMn	2,364	0.184	217	32 to 52
T4-1	Blank	2,580	0.218	284	16 to 35
T3-2	SiMn	2,375	0.188	223	24 to 44
T4-2	Blank	2,631	0.223	294	18 to 34

High- and Low-active-metal Ferro-silicons

The superiority of alloys containing calcium, aluminium, and zirconium as demonstrated by the above data indicated the desirability of determining the relative effectiveness of low- and high-active-metal content ferro-silicons. High- and low-aluminium grades were obtained from a major producer with the analysis of Low-aluminium FeSi, 93.00 Si; 0.45 Al; 0.01 Ca; High-aluminium FeSi, 90.57 Si; 2.20 Al, and 0.46 per cent. Ca. Data for irons inoculated with these alloys are found in Tables VII and VIII.

TABLE VII.—*Analysis of Irons Inoculated by Various Grades of Ferro-silicon.*

Iron.	Addition.	Composition, per cent.				
		C	Si	Mn	P	S
T26-3	0.5 per cent. Si, low-Al alloy	2.85	2.34	0.85	0.115	0.066
T26-4	0.5 per cent. Si, high-Al alloy	2.90	2.34	—	—	—
T27-1	Blank	2.84	2.39	0.83	0.122	0.066
T26-2	0.5 per cent. Si, high-Al alloy	2.86	2.29	0.85	0.115	0.066

TABLE VIII.—*Mechanical Properties of Iron with Various Inoculants.*

Iron.	Inoculant.	Trans., lb.	Deflec., in.	Res., lb.	Chill, 1/32 in.
T26-3	Low-Al,FeSi	2,591	0.230	298	13 to 29
T26-4	High-Al,FeSi ..	2,920	0.280	409	8 to 13
T27-1	Blank	2,490	0.232	289	12 to 20
T26-2	High-Al,FeSi ..	2,919	0.288	420	8 to 14

Comparison of iron T26-3, inoculated with the low-active metal-content alloy, with T27-1, the uninoculated blank, shows that the low aluminium and calcium alloy had a negligible value as an inoculant. Consideration of the data for the irons inoculated with the high active metal content shows the pronounced superiority of this active alloy. Although the amounts of aluminium and calcium added with the alloy were extremely small, it is difficult to explain the greater effec-

tiveness of the high-aluminium alloy on any basis other than the presence of the greater amount of the active metals. These results are in accord with the opinion of those employing the various grades of ferro-silicon in industry. These data afford evidence for a theory of inoculation based on the action of active metals. They also indicate the serious nature of failure to state the analysis of ferro-silicons with respect to these elements in research work.

Silicon as an Inoculant

Consideration of the above data pointed to the important role of the active metals in inoculation, and indicated the desirability of the following experiments being performed:—(1) Two ladles were tapped from heat T24; one ladle was treated with 0.50 per cent. Si addition of high-aluminium ferro-silicon and the other with a 0.50 per cent. addition of purified silicon. (2) A ladle from heat T26 was treated with 0.50 per cent. purified silicon for comparison with two blank or uninoculated irons. Results are presented in Table IX and X. The high-aluminium ferro-silicon was the one employed in previous experiments. The "purified" silicon employed was the highest grade commercially obtainable (99.8 per cent. Si, balance iron).

TABLE IX.—*Analysis of Various Irons, Inoculated with Purified Silicon and High Aluminium-Silicon.*

Iron.	Addition.	Composition, per cent.				
		C	Si	Mn	P	S
T24-S	0.5 per cent. Si as pure Si	2.78	2.61	0.91	0.130	0.059
T24-F	0.5 per cent. Si as High-Al FeSi ..	2.75	2.62	0.91	0.130	0.059
T26-1	0.5 per cent. Si as pure Si	2.87	2.32	0.85	0.115	0.066
T25-2	Blank	2.84	2.24	0.80	0.122	0.062
T27-1	Blank	2.84	2.39	0.83	0.122	0.066

TABLE X.—*Mechanical Properties of Various Inoculated and Blank Irons.*

Iron.	Inoculant.	Trans., lb.	Deflec., in.	Res., lb.	Chill, 1/32 in.
T24-S	0.5 per cent. Si as pure Si	2,601	0.218	284	8 to 21
T24-F	0.5 per cent. Si as High-Al FeSi ..	3,059	0.312	476	3 to 3
T26-1	0.5 per cent. Si as pure Si	2,533	0.210	266	13 to 36
T25-2	Blank	2,575	0.230	296	12 to 18
T27-1	Blank	2,490	0.232	289	12 to 20

Comparison of the results for irons T24-S and T24-F shows that pure silicon was much inferior in all respects to the ferro-silicon. Comparison of the values obtained for the blank heats T25-2 and T27-1 with T26-1, treated with 0.50 per cent. of silicon, indicates that silicon had no value as an inoculant, and suggests that withholding a portion of the silicon and adding it late may be slightly detrimental rather than beneficial to properties.

As a check on these experiments two additional heats were made in a 30-lb. high frequency induction furnace. Heat T55 was inoculated with a 0.55 per cent. addition of the high purity silicon (99.8 per cent. Si), and heat T46 was run as blank or control heat. Results are presented in Tables XI and XII, and are in good agreement with the data for the arc furnace irons.

TABLE XI.—*Data for Pure Silicon Additions to Induction Melts.*

Iron.	Addition.	Composition, per cent.				
		C	Si	Mn	P	S
T55	0.55 per cent. Si ..	2.83	2.05	0.93	0.16	0.058
T46	Blank ..	2.84	2.08	0.91	0.17	0.068

TABLE XII.—*Mechanical Properties of Two Irons, One inoculated with Silicon, and the Other Blank.*

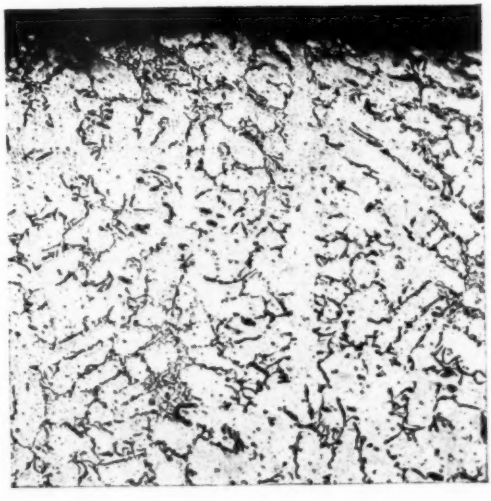
Iron.	Inoculant.	Trans., lb.	Deflec., in.	Res., lb.	Chill, 1/32 in.
T55	0.55 per cent. Si	2,460	0.201	247	20 to 48
T46	Blank ..	2,610	0.205	267	23 to 46

These data for high-strength irons render it difficult to support either the silica slime theory of inoculation, or the theory based on precipitation of graphite particles resulting from local concentrations of silicon. It may be that the silicon in commercial inoculants is simply a convenient carrier for active metals, or that the simultaneous addition of silicon with aluminium and calcium is in some way capable of improving graphite distribution and reducing chill.

Calcium as a Ladle Addition

In view of the evident importance of the active metals in the inoculation mechanism, experiments were undertaken to determine the effect of calcium and aluminium additions. In the case of calcium,

FIG. 4.—*Microstructure at surface of T8-S1 iron, treated with 0.3 per cent. Si as Si/Mn/Zr alloy. (Etched in nital ×100 magnification.)*



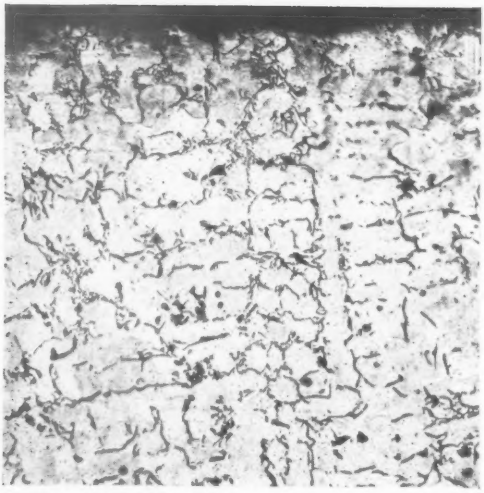


FIG. 5.—*Microstructure at surface of T8-C1 iron, treated with 0.35 per cent. Si in the form of Ca Si alloy. (Etched with nital* ×100 *magnification.)*

ladles were treated with 0.10, 0.75, and 1.00 per cent. of calcium for comparison with blank ladles; the additions were accomplished by wiring the metallic calcium to an iron rod and plunging the metal beneath the molten iron in the ladle, immediately after tapping. The resulting reaction was violent and it was apparent that a portion of the calcium burned at the surface of the molten iron. When solution and reaction were complete, the ladle was skimmed, the temperature allowed to drop to 1,455 deg. C. and the iron poured.

The chemical analyses and properties of the treated and blank irons are recorded in Tables XIII and XIV. Comparison with untreated iron T40-1B and T40-2B indicates that calcium metal is a very effective inoculant. Examination of the microstructures of the calcium-treated irons shows microstructures comparable to that of Fig. 2 for the calcium-silicon treated irons with practically all of the graphite at the immediate surface of the casting of the "A" type.

These data are significant and are strongly indicative of the major role played by calcium additions in determining the graphite distribution and properties of cast iron. Consideration of the data for the other experiments shows that those ladle additions which are free or relatively free of calcium (silicon-manganese, purified silicon, and "low-aluminium" ferro-silicon) are without value as inoculants, while there is a correlation between the calcium contents and the effectiveness of the other inoculants employed. Since excellent properties and structures were exhibited by the irons treated with pure calcium, it may be concluded that the late addition of silicon is not an essential part of inoculation.

TABLE XIII.—*Analysis of Iron Inoculated with Calcium.*

Iron.	Addition.	Composition, per cent.				
		C	Si	Mn	P	S
T39-1C	1.00 per cent. Ca ..	2.72	2.46	0.87	0.188	0.042
T39-2C	0.75 per cent. Ca ..	2.73	2.48	—	—	0.040
T40-1C	0.10 per cent. Ca ..	2.70	2.43	—	—	0.053
T40-1B	Blank	2.74	2.47	—	—	0.054
T40-2B	Blank	2.72	2.48	—	—	—

TABLE XIV.—*Mechanical Properties of Calcium Inoculated Irons.*

Iron.	Inoculant.	Trans., lb.	Deflec., in.	Res. in lb.	Chill, 1/32 in.
T39-1C	1.00 per cent. Ca	3,313	0.313	518	2 to 3
T39-2C	0.75 per cent. Ca	3,389	0.341	578	4 to 6
T40-1C	0.10 per cent. Ca	3,245	0.292	474	5 to 12
T40-1B	Blank	2,390	0.191	228	12 to 28
T40-2B	Blank	2,455	0.197	241	14 to 24

Aluminium Additions

Some of the alloys which have been found effective as inoculants contain aluminium. The "high-aluminium" ferro-silicon contained 2.20 per cent. Al and 0.46 per cent. Ca; and the zirconium alloy, 1.50 per cent. Al and 2.19 per cent. Ca. In an effort to evaluate the effect of aluminium, additions of 0.07 and 0.50 per cent. Al were made for comparison with untreated irons.

Aluminium additions were made in the same manner as the calcium additions—by wiring high-purity aluminium (99.99 per cent. Al) to an iron rod and plunging beneath the surface of the metal in the ladle. Data on the analysis and properties of the treated and blank irons are presented in Tables XV and XVI. The effect of aluminium additions on the mechanical properties was negligible, but the effect of the 0.50 per cent. addition on the chilling tendency was marked.

TABLE XV.—*Analysis of Aluminium Treated Iron*

Iron.	Addition.	Composition, per cent.				
		C,	Si,	Mn,	P,	S,
T34-1A	0.50 per cent Al ..	2.82	2.26	0.82	0.117	0.064
T34-1B	Blank	2.84	2.33	0.86	0.122	0.064
T34-2A	0.07 per cent. Al ..	2.84	2.28	—	—	0.062
T34-2B	Blank	2.82	2.31	—	—	0.061

TABLE XVI.—*Mechanical Properties of Aluminium Treated Irons.*

Iron.	Addition.	Trans., lb.	Deflec., in.	Res. in lb.	Chill, 1/32 in.
T34-1A	0.50 per cent. Al	2,450	194	238	2 to 8
T34-1B	Blank	2,478	212	260	8 to 31
T34-2A	0.07 per cent. Al	2,465	211	260	11 to 30
T34-2B	Blank	2,455	212	258	14 to 23

Examination of the microstructure of the treated and blank irons showed no improvement in the graphite distribution in the aluminium-treated irons. However, a tendency of the treated irons to have larger amounts of ferrite associated with the type D graphite was observed. Apparently aluminium is capable of reducing chilling tendency and carbide stability without an improvement in graphite distribution, thus indicating that high chilling tendency is not a necessary concomitant of abnormal graphite distribution. These data make it difficult to base a theory of inoculation on a reduction

of carbide stability. No adverse effect of the aluminium additions was observed on the soundness of the transverse bar castings.

Effect of Various Inoculants on Cell Size

The cell size of cast iron refers to the size of the eutectic units in the solid iron. Theories have been proposed to explain graphite size and distribution variations on the basis of variations in the rate of formation of the austenite and the graphite flakes of the eutectic cells. It is apparent that the number and size of the cells in the solidified iron is an important theoretical consideration, inasmuch as it indicates the possibility of a cell nucleation by inoculants.

The cell size is not made evident by ordinary polishing and etching procedures. Adams[3] has discussed a method for delineating the cell boundaries by deep etching with Nital and has presented a cell-size chart with numbers ranging from 1 to 7, with low numbers representing a large cell size. Size No. 2 represents an average cell diameter of approximately one inch at a magnification of twenty-five times; No. 3, a cell diameter of three-quarters of an inch, and No. 4, of one-half inch. Using the deep-etch method and this chart, the Authors have determined the cell size of a number of significant irons of this report. Data are presented in Table XVII, where the treated irons are compared with the corresponding blanks of the same horizontal row. Comparison of the irons and the blank or untreated irons of the first three rows shows that calcium additions caused a decrease in cell size.

TABLE XVII.—*Data from Cell Size Determinations.*

Iron.	Per cent. addition.	Cell size.	Iron.	Addition.	Cell size.
T39-1C	1.00 Ca ..	4	T40-1B	Blank	3
T39-2C	0.75 Ca ..	4	T40-1B	Blank	3
T40-1C	0.10 Ca ..	4	T40-2B	Blank	3
T2-C2	0.70 CaSi..	3	T2-F2	0.60 per cent. FeSi	2
T24F ..	0.50 FeSi ..	3	T24S	0.50 per cent. Si ..	2
T34-1A	0.50 Al ..	2	T34-1B	Blank	2
T34-2A	0.07 Al ..	2	T34-2B	Blank	2

Iron T2-C2 was inoculated with calcium-silicon and iron T2-F2 with a ferro-silicon which contained a low content of Ca (0.25 per cent.). The calcium-silicon produced a reduction in cell size as compared with the iron inoculated with the ferro-silicon. Iron T24-F was treated with a high active-metal FeSi (0.46 per cent Ca) and iron T24-S with pure silicon. It is apparent that ferro-silicon containing some active metal is capable of effecting a reduction in cell size.

Consideration of the aluminium-treated irons and the corresponding blanks in the last two rows of the table leads to the conclusion that aluminium additions had no influence on cell size. These data indicated that the addition of an effective inoculant brings about a reduction of cell size.

Decarburization by Calcium

During the experiments in which calcium was added to the ladle, either as calcium metal or as calcium-silicon, a tendency towards lower carbon content in the treated irons was observed. When the calcium addition was larger, the amount of carbon lost was measurable and consistent. Table XVIII gives some data obtained with calcium-treated irons as compared with some blanks ladles from the same heat.

TABLE XVIII.—*Decarburization by Calcium Additions.*

Ca added, per cent.	Carbon content, per cent.		
	Blank ladle.	Treated ladle.	Loss in C
1.11	3.08	2.84	0.24
1.00	2.91	2.72	0.19
1.00	3.04	2.87	0.17
0.75	2.85	2.73	0.12

After cooling, the ladles to which calcium or calcium-silicon additions were made were found to be coated with a grey powder. When moistened, this powder evolved a gas which burned and which possessed an odour characteristic of the acetylene gas produced by moistening commercial calcium carbide.

These observations indicate the formation of a carbide of calcium of high stability and low solubility in grey iron; metals treated with calcium, or alloys containing calcium, and suggest the possibility of calcium-carbide formation being involved in the inoculation mechanism.

The data on sulphur analysis indicates that the addition of 1 per cent of Ca has a slight desulphurizing effect, reducing the sulphur content by about 0.01 per cent.

Summary and Conclusions

The experiments of this report indicate that the production of type "A" graphite by inoculation is primarily a process of the addition of active metals rather than a matter of the addition of silicon. Alloys (such as certain grades of ferro-silicon and silico-manganese) which are very low in their aluminium and calcium contents, and the element silicon were without value as inoculation agents. The effectiveness of the alloys investigated increased with increasing calcium and aluminium contents, the most effective alloy being calcium-silicon with approximately 30 per cent. of calcium. Metallic calcium was found to be a very effective inoculant.

The conclusions of this report are based on experiments with high-strength, indirect-arc, electric-furnace irons. The relatively low-carbon, high-strength irons were selected for this investigation because of their tendency towards unfavourable graphite distribution and their sensitivity to inoculation additions.

Specific conclusions and observations from this report are:

1. The element silicon was not effective as an inoculating agent.

2. Silico-manganese, which was relatively free of calcium and aluminium, was not effective as an inoculant.

3. The inoculating ability of various commercial grades of ferro-silicon increased with the calcium and alumihium contents. Low-calcium grades had very little effect.

Inoculation of Grey Cast Iron

4. Silicon-manganese-zirconium alloys containing somewhat more calcium than is found in commercial ferro-silicon were more effective than ferro-silicon.

5. The most effective inoculant for the improvement of mechanical properties in these experiments was the calcium-silicon alloy with approximately 30 per cent. of calcium.

6. Metallic calcium additions to the ladle brought about marked improvements in mechanical properties and graphite distribution. With the exception of calcium-silicon, calcium was superior to all other inoculating agents tested in these experiments.

7. Metallic calcium was effective in reducing chilling tendency.

8. Calcium was effective in reducing the cell size of cast iron microstructures.

9. Calcium additions gave a reduction of the carbon content of molten iron by formation of calcium carbide of low solubility, and it is suggested that calcium carbide is involved in the mechanism of type "A" graphite formation by nucleation of eutectic solidification.

10. Although aluminium was a very powerful chill reducer, its addition to cast iron in certain amounts did not promote type "A" graphite distribution. This indicates that chill reduction is not necessarily associated with an improvement in graphite distribution.

REFERENCES

[1] H. W. Lownie; "Theories of Gray Cast Iron Inoculation," *Transactions* of the American Foundrymen's Association, **54**, p. 837 to 844.

[2] C. Burgess and R. Bishop; "Alterations in Cast Iron Properties Accompanying Use of a Strong Inoculant of the Silicon-Manganese-Zirconium Type," *Transactions* of the American Foundrymen's Association, **52**, p. 671.

[3] R. R. Adams; "Cast Iron Strength *versus* Structure," *Transactions* of the American Foundrymen's Association, **50**, p. 1063.

Research into All-steel Planes

Present claims of wonder metals should be treated with reserve, said Mr. W. J. Taylor, Parliamentary Secretary to the Ministry of Supply, speaking to the Sheffield Publicity Club recently. The cost of producing them on anything like the required scale would be too high to make them a commercial proposition, and he believed that they must look to the development of steel in new forms to fill the need.

Aluminium-alloys were being used almost exclusively in the construction of aeroplanes, because they were strong and light, but the point was being reached when something stronger would be required. His Ministry was now engaged in research into an all-steel aeroplane.

Sheffield had never failed to meet the very exacting requirements of the aircraft industry and would match the new steel which they were told was being made in the United States and which would enable aircraft to reach 2,700 m.p.h. without heat damage. Of atomic power in aircraft engines, Mr. Taylor said that it would tax the designers and metallurgists to the utmost, but "Sheffield University, Sheffield scientists and leaders of industry are helping us all the time in the solution of our problems. We rely upon them a great deal and we never ask for anything they do not give," he added.

Iron Castings for Atomic Plants

In a leading article on "More Regulations" published in the JOURNAL of August 8, it was stated that iron castings were being used to replace lead shielding in atomic power plants. Further news on this subject received from the Newburgh Engineering Company, Limited, reports that this firm was recently asked to supply a considerable tonnage of cast-iron biological shielding blocks for use in connection with the current atomic-energy programme. No definite grade of iron was called for, except that the blocks were required to comply with a specification calling for 3 per cent. maximum porosity. The policy was adopted that any porosity visible on a radiograph of a casting would be considered as a cause for rejecting that casting. In making these blocks, the phosphorus and sulphur contents of the metal were kept to very low figures, whereas the carbon was on the high side to prevent complications in feeding. Using an exothermic sleeve and normal foundry practice to ensure progressive solidification, 36 tons of these blocks, varying in weight from 1 to 15 cwt. were produced. All the blocks were radiographed without disclosing any faults and after final machining, the castings were given a gamma penetration test, using a 1012B monitor CO_{60} isotope and scintillation counter and all were found to be within "limitation of 3 per cent. porosity."

BSI Methods of Analysis

The British Standards Institution has recently issued parts 8, 9, and 10 of B.S. 1728:1957 "Methods for the Analysis of Aluminium and Aluminium-alloys." Part 8 specifies an absorptiometric method for determining iron in alloys containing smaller amounts of iron, and is an alternative method to the volumetric method in Part 6. Parts 9 and 10 relate to the determination of manganese. The volumetric method specified in Part 9, is intended for use with alloys containing higher percentages of manganese than those which would normally be determined by the absorptiometric method in Part 10. Elements dealt with in other parts of the series were copper, magnesium, zinc, iron and manganese.

The standard specifies the reagents to be used and certain recommended methods of sampling and test procedure. An indication is given of the expected reproducibility, derived from experiments carried out by a number of independent analysts. Copies of these standards may be obtained from the sales branch of the Institution at 2, Park Street, London, W.1; price 3s. each.

Colvilles' Training Scheme

Full-time studies in metallurgy and in mechanical and electrical engineering are to be undertaken by 17 students under the scholarship scheme of Colvilles, Limited, Glasgow. With the exception of one student, who will go to Edinburgh University, they will all attend the Royal College of Science and Technology, Glasgow.

The value of these scholarships is salary at normal rates during attendance at the College and during training, plus the cost of the course fees, a total of £350 to £500 yearly, depending on age and service of the students. The duration of the courses is from two to four years. The period at college is co-ordinated with carefully planned practical training during the summer vacation.

British Melting Furnaces for Canada

An order worth approximately $500,000 has just been obtained by G.W.B. Furnaces, Limited, of Dudley, from the Canadian Steel Wheel Company, Montreal, for two 40-ton capacity direct-arc steel-melting furnaces. The background to this order is that after January 1, 1958, no cast-iron wheels are to be fitted to Canadian or American rolling stock. Wheels will, therefore, be of steel and either cast or forged. Two American-controlled companies operating in this field are going forward with plans to manufacture cast-steel wheels, while the Canadian Steel Wheel Company is to manufacture wheels of the forged type.

The three-phase direct-arc melting furnaces will be to the designs of the British company's Italian associates, Leone Tagliaferri & Company of Milan, although the complete furnace (except the refractories and some ancillary equipment which will be obtained in Canada) will be supplied from this country. These 40-ton furnaces will have a 16-ft. dia. shell and will be rated at 17,500 kva. through an on-load tapped transformer; three 18-in. dia. graphite electrodes are to be fitted in each furnace. Following the latest steelworks practice, the furnaces are of the top-charging type in which the roof is lifted and swung aside to receive the charge from drop-bottom charging baskets. The three graphite electrodes are to be controlled hydraulically by means of the patented Tagliaferri system. As might be expected, this order was obtained in the face of intense American and German competition. The customer's engineers made thorough investigations as to the designs of melting furnaces available and were favourably influenced towards hydraulic control by the recommendations of Premier Steel Mills, Limited, of Edmonton, Alberta, who have recently commenced operating their second G.W.B.-Leone Tagliaferri 12-ton melting furnace.

Latest Foundry Statistics

According to the British Bureau of Non-Ferrous Metal Statistics the production of copper-base alloys during July was 6,114 tons. In the first seven months of this year output was 195 tons less than for the corresponding period of last year. The figure of 650 tons of pure-copper castings is reported—an amount which apparently remains constant month by month.

The Ministry of Supply reports that the output of aluminium castings during June was 6,994 tons of which 2,246 tons were from sand moulds; 3,424 tons as gravity-die-, and 1,324 tons as pressure-die-castings. The production of magnesium castings during this month was 181 tons.

The Council of Ironfoundry Associations announces that the number of ironfoundry workers employed in the United Kingdom during the week ended August 3 was 128,156 males, and 9,572 females, giving a total of 137,728. This figure is 45 fewer than a month ago and 5,267 fewer than a year ago.

DORMAN LONG (AFRICA), LIMITED—Mr. P. Sceales has been appointed vice-chairman in place of Mr. R. V. Shore, who remains on the board.

JOHNSON & PHILLIPS S.A. (PTY.), LIMITED—Mr. E. H. Bennett has been appointed managing director in succession to Mr. H. L. Dawe, who remains chairman of the company.

Street-furniture Design

The Minister of Transport and Civil Aviation has invited the Council of Industrial Design to add several new categories to the Council's list of approved street-furniture designs. This continues the Minister's general policy of improving the design standards of street furniture. The Minister intends that new street furniture on trunk roads should comply with these approved designs as soon as this becomes practicable. The new categories will include passenger 'bus shelters, bollards, guard rails, litter and grit bins and other road-side items. Designs of these will be considered by the street-furniture panel of the Council, which the Ministry entrusted in 1954 with the responsibility for maintaining an "Approved List of Street-lighting Columns."

Manufacturers of these products who wish to be represented on this new list—and architects, designers and authorities who have produced designs which could be made available to manufacturers—are invited to submit details to: Mr. Peter Whitworth, secretary to the street-furniture panel, Council of Industrial Design, 28, Haymarket, S.W.1. A list of items in these new categories will, when published, be made available to local authorities and other interested organizations.

Institute of Metals Symposium

A symposium on "Vacancies and Other Point Defects in Metals and Alloys" is being arranged by the metal physics committee of the Institute of Metals to be held at Harwell on December 9 and 10. On the first day there will be a visit in the afternoon to certain aspects of research work at the Atomic Energy Research Establishment, together with a brief visit to the reactor DIDO, while in the evening there will be an introductory lecture, for the benefit of non-specialists, by Professor R. W. K. Honeycombe, of the University of Sheffield.

The second day will be devoted to the symposium itself and the discussion will be based on a series of six papers, which will be available, in advance, only to those who register for the meeting. Details of the meeting, with registration form, will be sent to all members of the Institute. Non-members should apply for copies to the secretary, the Institute of Metals, 17, Belgrave Square, London, S.W.1.

UK Industrial Cinema at Brussels Exhibition

A cinema for the showing of 16- or 35-mm. industrial films of all types will be a feature of the British Industrial Pavilion at the Universal and International Exhibition to be held at Brussels from April 17 to October 19, 1958. This cinema will seat over 200 people and be open every day during all hours of the Exhibition. It may be used not only for the showing of documentary films but also—at the same charge—for demonstrations, lectures or discussions.

Any British firm, whether exhibiting in the Industrial Pavilion or not, can take part in the cinema programme at fixed charges ranging from £13 10s. per hr. for five hours to £12 10s. per hour for over 50 hours. Further details of the cinema can be obtained from Mr. W. Newman, British Overseas Fairs, Limited, 21, Tothill Street, London, S.W.1.

Equipment & Supplies

Pressure-jet Oil-burners

At present, Riley (I.C.) Products, Limited, 19, Woburn Place, London, W.C.1, manufacture only gun-type pressure-jet burners. This type consumes oil at a fixed rate, a constant supply of air being maintained; heat input to a furnace is regulated by automatically switching the burner on and off, thereby maintaining an average rate of heat supply. Fuel economy is obtained by ensuring that the minimum possible amount of air is supplied in excess of that theoretically required for complete combustion, this demanding very efficient air mixing at the ignition point. The company are shortly to use two burners and a recirculatory flue-gas system in a large core-drying oven in their own works. Automatic controls will ensure :—(1) Limitation (to 232 deg. C.) of the temperature of the gas entering the recirculating fan; (2) rapid initial heating-up, and (3) progressive reduction of fuel consumption, as the oven-heat requirement diminishes, whilst maintaining an oven temperature of 200 deg. C.

The initial high flame-temperature (*circa* 1,500 deg. C.) will be reduced to the fan-inlet temperature of 230 deg. C., by mixture of exhaust gas, from the oven, with fresh combustion products. The use of recirculated exhaust gas is claimed to be more economical than temperature reduction with cold air.

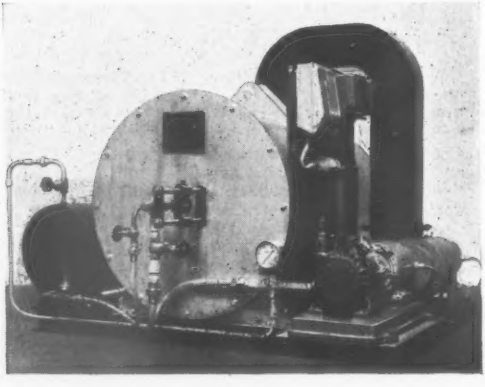
A burner, utilizing low-pressure air for atomizing, is at present being developed. With this, a single control will vary oil and air in the same pre-set ratio, so that whatever the rate of firing, the furnace atmosphere will be constant. This burner will be designed to utilize preheated air, or cold air as desired. It will have a turndown ratio of 5 : 1 and will be made in a series of convenient capacities. It is claimed that the burner will be suitable for general-furnace applications, including the various sizes of metal-melting crucibles and small reverberatory furnaces.

Portable Mould Drier

Modern Furnaces & Stoves, Limited, Booth Street, Handsworth, Birmingham, 21, announce that they are marketing an addition to their range of portable mould driers, under the name "Junior" (being a self-contained but smaller edition of the "Newstad"). The unit (Fig. 1) comprises a cylindrical chamber (lined with refractory) which is heated by means of a medium-pressure oil-burner; a self-contained air compressor; fuel-storage tank (10 gal. capacity), and electrical-control equipment, all of which, together with power supply, is fed from only one plug. The drier is mounted on a cast-iron bedplate, and transportation is facilitated by the provision of a mild-steel bridle welded to the top of the combustion chamber.

An important feature of this equipment is the low headroom required (3 ft. 9 in.). The thermal output of the unit can be adjusted between 300 cub. ft. per min. at 200 deg. C. and 150 cub. ft. per min. at 300 deg. C.

FIG. 1.—*"Junior" self-contained portable mould drier, manufactured by Modern Furnaces & Stoves, Limited. It has a thermal output of* 250,000 *B.Th.U. per hour.*



Grinding Machine

Roland Goodall, Limited, 19, Station Street, Burton-on-Trent, British agents for the Greif range of equipment, announce the introduction of a high-speed, rough-grinding machine, designated K.V.S. 50. The equipment features two independent grinding-spindles, together with infinitely variable V-belt drives and intermediate shaft arrangements, which are claimed to produce constant peripheral speeds (8,850 ft. per min.) by compensating for diametric losses by increasing r.p.m. The grinding wheels used are 20-in. dia. by 2½-in. thick. The machine, which is stated to conform fully to safety regulations, is encased in a smooth streamline housing.

SHALLWAY INTERNATIONAL CORPORATION, 1,450, University Avenue, Palo Alto, California, USA, has placed on the market, Shalco SCO-70 Carb-off, corebox and pattern cleaner. This is a specially-developed liquid, for rapid and easy removal of carbon "build-up" from shell-coreboxes and mould boxes. The liquid is claimed to be non-corrosive to aluminium, magnesium, brass, iron and steel.

WOLF ELECTRIC TOOLS, LIMITED, of Pioneer Works, Hanger Lane, London, W.5, have added two entirely new models to their already comprehensive range of electric drills, in response, it is claimed, to the growing need of industry for power tools combining improved performance with lower weight. The two units are the ¼-in. general-duty drill, type OK2c, and the heavy-duty model, type KG2c, also fitted with a ¼-in. chuck.

RESINOUS CHEMICALS, LIMITED, of Blaydon, County Durham, emphasized the relationship between the plastics industry and the foundryman at the British Plastics Exhibition, held recently at Olympia. The company exhibited their range of special resins for the shell-moulding process, and quoted financial economies gained over green-sand moulding, together with a demonstration of the bonding of half shells by resinous adhesives.

BROWN & TAWSE PLANT, LIMITED, Ambrose Street, West Gorton, Manchester, 12, announce the introduction of a new crane—marketed as the "Hy-Mobil 45"—of 45 cwt. capacity at 17 ft. 3 in. height, and 35 cwt. at 18 ft. 5 in. The crane, with a totally enclosed cab, is mounted on a Morris four-wheel-drive chassis with five-speed gearbox, and is fitted with 10.50 by 16-in. heavy-duty tyres. The unit is claimed to be extremely rugged and is designed for arduous working conditions.

Institute of Vitreous Enamellers

Twentythird Annual General Meeting and Conference in Chester

The twentythird annual general meeting and annual conference of the Institute of Vitreous Enamellers was held in the Grosvenor Hotel, Chester, on October 3 and 4. Over the period nearly 200 members and guests participated in the technical sessions and social functions.

The whole of the first day was devoted to a visit to the works of John Summers and Sons, Limited, at Shotton where members were privileged to see all the processes from the blast furnace to the coating of the finished cold-rolled strip.

Chairman's Report

At the annual general meeting which was held on the morning of October 4, Mr. W. Thomas (chairman of Council) presided. On rising to present his report on the year the chairman expressed his pleasure at welcoming so many new delegates to the conference. He hoped that the conferences were continuing to meet a real need and attracting interest.

Dealing with the work of the Institute over the past year, Mr. Thomas first came to some resignations and retirements of members who had been connected with the Institute since its foundation. Mr. H. Whitaker, though remaining a member of the Institute, had resigned from the Council, feeling that he should give way to a younger man. He was a founder member and the Council regretted his departure and thanked him for all the work he had done since 1934. Another retirement was that of Mr. Alastair McLeod, who for many years had been chairman of the publications committee, which provided the papers for the conference, and sincere thanks were due to him. The Council hoped that he would maintain his connection with the Institute and had elected him as an honorary member. Finally, Mr. R. R. Fyfe-Smith would be leaving this country for two years. The Council thanked him for his work on behalf of the Scottish section, and wished him a happy and successful period abroad.

An important feature of the past year had been the change in the constitution of the Institute. Thanks to the tremendous amount of work done by the development committee and its chairman Mr. John Hooper, new Articles and Memoranda of Association had been produced which brought recognition for the Institute as a non-profit-making technical body and rendered it unnecessary to use the word "Limited" in its title. It had been necessary in the past for the Institute to deal with certain items which were partly commercial in nature. The Institute was a purely technical body and should not have to be concerned with anything having a commercial flavour. With the formation of the new body, the Vitreous Enamel Development Council, it had been possible to hand over to it the quasi-commercial work hitherto done by the Institute, principally in regard to raw materials. The Institute had always had a raw materials committee, and during and after the war had negotiated with the Government on matters relating to the import of raw materials which were vital for the enamelling industry. That could hardly be regarded as a purely technical activity, and the chairman was glad that it had been possible to hand it over to the new body. The thanks of all the members were due to Mr. Hooper and his committee.

International Work

The Institute had organized two international conferences on vitreous enamelling in recent years, and, to follow up the work which had been done, consideration was being given by those concerned in the various European countries to the idea of setting up an international body which would look after the technical interests of vitreous enamelling, particularly by arranging international conferences, and which would correlate the efforts of the various bodies concerned. To that end a meeting was being held in Brussels in the near future to which would be invited representatives of the Institute and of its various European counterparts.

The committees and sub-committees of the Institute had done good work. The *Atlas of Defects* had been very well received, both in Europe and in America, and members' thanks were due to Mr. A. Biddulph for all that he had done in that connection.

A new development had been to secure the co-operation of the laboratories of certain firms, and one in particular, in the enamelling industry to carry out investigational work in conjunction with a sub-committee of the Institute on the effect of detergents on enamels. This was a most complicated problem. There was need for a standard test which could be adopted by the British Standards Institution for the effects of detergents on enamels. A great deal of investigation was required to ensure that nothing was put in a standard specification which would be open to criticism. If there seemed to be delay in publishing a detergent specification it was due to the need to get all the facts correct first.

Through the good offices of the president, a scheme had been put to the British Iron and Steel Research Association for work to be done on interfacial reaction between enamels and steel. The matter was still being considered, but it was hoped that the director of BISRA would view it favourably.

In the minutes of the previous meeting there had been reference to the apprenticeship scheme, and he would like to emphasize the great advantages which employers could receive by interesting their younger employees in this scheme. Three or four apprentices had now gone through the whole scheme and ended their indentures. The industry badly needed thoroughly-trained young men.

Institute of Vitreous Enamellers

The summer school at Droitwich had been, he thought, the most successful which the Institute had yet held, and their thanks were due to those who had done so much to make it a success, and particularly to Mr. J. H. Gray, the chairman of the education committee.

In conclusion, the chairman thanked the chairmen and members of the committees and sub-committees, who had given so much time to the work which resulted in the various reports published by the Institute from time to time, and the secretary, Mr. J. D. Gardom, and his staff for the work which they had done for the Institute.

In the absence, abroad, of the hon. treasurer, Mr. W. S. Grainger, the financial report was embodied in the chairman's report and both were adopted by the meeting. A formal motion was then proposed by the president, Mr. C. R. Wheeler, C.B.E., for the election of Mr. W. T. Wren as president-elect of the Institute for the ensuing year. This was seconded from the chair and carried with acclamation.

Institute Awards

The chairman expressed his regret that no entries had been received for the Whittle competition and hoped that the younger personnel of the industry would submit entries for this award during the coming year. However, he was pleased to be able to report that on the unanimous recommendation of the library and publications committee, Council had awarded the W. S. Grainger medal to Mr. S. H. Ryder for his paper on "Current Mill-room Practice."

The result of the ballot for the election of three members to fill vacancies on the Council was next announced, the elected members being Mr. J. Hooper, Mr. T. J. MacArthur and Mr. W. Thomas.

Following the annual general meeting the first technical sessions of the conference was held at which Dr. W. H. F. Tickle and Mr. D. A. Winton discussed the subject of "Continuous Surface Pretreatment Processes at Shotton with particular reference to Nitec Sheet for Vitreous Enamelling." This discussion was augmented by the showing of the film "Zinc Controls Corrosion." At the second technical session a paper was presented by Mr. J. A. Clark on "Abrasion-resistance Tests." Following luncheon the three technical sessions in the afternoon were taken up with papers on "Enameling of Aluminium" by Mr. Biddulph, "Application of Vitreous Enamel by the Electro-static Process" by Mr. S. Hallsworth, and a discussion forum on "Enamelling in Architecture" introduced by Mr. E. Mackasek and Mr. T. J. MacArthur.

In the evening the conference culminated in a reception by the president and chairman of Council and their ladies, which was followed by the annual banquet. Among the official guests entertained by the Institute at this function were the Rev. E. J. Lawson, Mayor of Chester, Mr. S. W. Vickery, chairman of the Vitreous Enamel Development Council, who proposed the toast of the Institute and the enamelling industry, the Rt. Reverend Gerald Ellison, Lord Bishop of Chester, who responded to the toast of the guests, Mr. J. W. G. Pedder, chairman of the Vitreous Enamellers Association, and Mr. C. E. Ramsden, president of the Society of Glass Technology. The banquet was followed by dancing.

Notes from the Branches

Birmingham

The September meeting of the Birmingham branch of the Institute of British Foundrymen was held in the James Watt Memorial Institute on Wednesday, 25th. The meeting commenced with the presidential address given by Mr. J. W. Dews, who introduced his subject by mentioning several aspects of the question of friendship and remarked that "life is now so full of striving for various objects that a person may have many acquaintances but few real friends. It has been said that the foundry industry is the basis on which civilization has been founded and therefore as foundrymen we have a particular responsibility for carrying on and improving our civilization. By joining the Institute and taking part in its activities we can make many friends and at the same time help to improve our civilization." He went on to say, "through the Institute a free exchange of ideas between theoretical and practical men must take place to encourage the ideal of the Institute's motto 'Science hand in hand with Labour.' We must take a more active part in the discussions at branch meetings and having done this, the next step is to present a paper to the branch or enter a paper for the branch short-paper competition." Mr. Dews concluded by saying how much he personally owed to the many friends he had made through participating in Institute activities, particularly those of the Birmingham branch. He was thanked by Mr. E. Hunter for his very able address.

"Gating for Production"

The president then introduced Mr. Leonard Clarke, a member of the branch, who gave a paper entitled "Gating for Production." The paper, which was illustrated by approximately 20 slides and two short films, was in the form of a questionnaire involving the answers to 22 questions. It covered running systems *vis à vis* space in moulding boxes, fluidity, speed of flow, slag traps and mould/core erosion. Further questions involved chaplets, gas escape, pouring position and breaking-in.

Mr. Clarke next turned to fettling costs, the machining of thin sections and soundness in heavy sections, following this with feeding systems in relation to machine moulding, jigging locations and the question of positioning a critical face in the correct position. He also dealt with contraction stresses and the question of yield, continuing by a mention of pouring-bush quality—with special reference to an automatic lifting plug he has designed 10 years previously. The speaker queried whether ingates as normally designed really functioned properly or gave excessive turbulence. Finally, chills and denseners and casting strain and their effect on weight, dimensional-accuracy and electrical permeability, were dealt with.

Mr. Charlton proposed a vote of thanks to Mr. Clarke for presenting such an enjoyable paper, and Mr. Pearson seconded the proposal. An open discussion then took place in which many members joined.

Royal Heraldry in Cast Iron

By C. J. Robb

English baronial mansions, in the early days, had a central hearth situated in the Great Hall, whereon logs blazed and smoke made its escape through a louvred opening in the roof. The atmosphere was very fuliginous and disagreeable to the noble occupants with the result that a fireplace, recessed in the wall, was devised with an ascending flue. Then came the problem of preserving the stonework and brick from the glowing embers and flames; this was overcome by fixing cast-iron firebacks, as a thermal shield. These decorative plates were cast in open sand moulds and embossed with coats-of-arms, scriptural subjects, figures of classical tales and allegories and other designs of fancy.

FIG. 1.—*Royal monogram of George III cast in the eighteenth century, by the Carron Company.*

A fine collection of black-iron firebacks can be seen in the Victoria and Albert Museum. The Royal arms and insignia are depicted on many of these, commencing with those of the Tudor Sovereigns. An outstanding example is of the arms of Philip II of Spain dated 1595 in bold relief; another heraldic fireback, used by the Stuart Sovereigns with the initials C.R. and dated 1635, is also of interest—these were the early examples of Royal heraldry in the founders' art. There is evidence that in the days of Queen Elizabeth I the crown was embossed on cast-iron cannons, and later the Royal cipher of James I also appeared. When James II reached Dublin, during the War of the Revolution, an ironmaster of that city cast a shield with the crown surmounting the cipher "J.R.", which it was proposed to erect on the old Parliament House, when the King gained control of all Ireland as his kingdom.

The patternmakers of the 18th century were indeed expert at their job—the fine cast-iron monogram of George III cast by the Carron Company (Fig. 1) is a good example of their capabilities. The Post Office made use of castings bearing the Royal insignia as signs on pillar boxes, and the crown ornates four pediments of the modern telephone kiosks, designed by the celebrated ecclesiastical architect Sir Giles Scott. Castings have also become associated with heraldry used in places other than Crown property, appearing on hotel façades, bearing the titles "Royal," "King's," and "Queen's," and on premises where Royal Warrants of Appointment were held.

Earnings Doubled in 10 Years

In the past 10 years average earnings in a wide range of British industries have nearly doubled. Provisional figures, which showed that the earnings of adult male workers have now passed the £12 a week mark, have been confirmed in statistics published by the Ministry of Labour. Second in the list of adult male workers' earnings come those in the metal manufacturing group with £13 11s. 3d. a week, and those in vehicle manufacture are third at £12 18s. 11d.

For the fourth month in succession the index of wage rates (January 31, 1956 = 100) for all workers remained unchanged in August at 111. Among the main increases, which resulted in an aggregate of £314,000 extra in the weekly full-time wages of about 1,066,000 workers in the manufacturing group, were those in iron and steel.

About 207,000 working days were lost during August because of industrial disputes, against 872,000 in July. Over the first eight months of this year stoppages involved the loss of 8,036,000 working days, compared with 1,563,000 working days in the same period last year. Britain's working population at the end of July was 23,981,000, 19,000 more than at the end of June. The total at the end of July last year was 24,125,000.

Japanese International Trade Fair

The Fifth Japanese International Trade Fair is to be held at Osaka, from April 12 to 27, 1958. Exhibits will be grouped under various headings which include "metals and metal products;" "machine and hand tools;" "transport equipment;" "raw materials," and "fuels." Founders interested in having their products shown should ensure that applications for space are made before November 30. Further particulars can be obtained from the secretary general, Japanese International Trade Fair Commission, 58, Honmachibashi, Higashi Ku, Osaka, Japan.

Publications Received

Country Industries—The Annual Report of the Rural Industries Bureau 1956-57. Issued by the Bureau from 35, Camp Road, Wimbledon Common, London, S.W.19. Price 1s. 6d.

It is curious that whilst engineering, woodworking and clay industries are all catered for by the Bureau, the rural foundry does not come in for consideration. Yet there is a section of the foundry industry which would qualify for the appellation "rural." Such small foundries are, or were, to be encountered in North Yorkshire and Devon.

According to this Report, rural engineers are suffering from their inability to provide themselves with up-to-date machinery. It may be, however, that much development in this direction would exclude them from being essentially "rural" except as to location. The Report makes interesting reading, and the work being done in a new workshop set up by the Bureau for the restoration of period-furniture shows meritorious initiative.

BCIRA Journal of Research and Development. Vol. 7. No. 1. Issued by the British Cast Iron Research Association, Alvechurch, Birmingham.

There are three reports in this issue. The first is from Mr. J. V. Dawson whose paper covers the "Effect of Aluminium on the Inoculating Power of Ferro-silicon and its Tendency to give Pinholing." In his conclusions the author states:—(1) There is an increased tendency for ferro-silicon to cause pinholing in nodular cast iron as the aluminium content of the ferro-silicon increases. (2) In nodular-iron castings of relatively light section poor inoculation is obtained when the aluminium content of the ferro-silicon is low. This difference is not so obvious in heavier sections. (3) The inoculating effect of ferro-silicon in ordinary grey cast iron is greatly increased by the presence of aluminium in the inoculant. This effect can also be obtained by suitable additions of aluminium either before or in conjunction with the ferro-silicon addition. It does not, however, occur when the aluminium is added after the ferro-silicon has dissolved. (4) The increased inoculation due to aluminium gives a significant improvement in mechanical properties in the type of grey cast iron used in these experiments.

The second paper by Mr. I. C. H. Hughes, M.SC., is entitled "Preliminary Study of the Mode of Solidification of Chill-test Castings." His conclusions which are subject to further experimental confirmation are:—(1) The factors governing the grey or white solidification of the eutectic are the composition and thermal history of the iron, and its rate of cooling through the eutectic solidification range. There is probably a critical cooling rate through the eutectic solidification range for every sample of iron, above which it will be white and below which it will be grey. (2) In a chill-test casting of the type conventionally used (with a chill at the base—Editor), the effect of the chiller in accelerating cooling moves up the casting during cooling. All points cool slowly, due to the sand walls, until reached by the chill effect, when their cooling rates increase sharply. (3) Mottle results when grey, eutectic solidification begins under the cooling influence of the sand walls, but is succeeded by white eutectic solidification when the chill effect is felt before the completion of solidification. (4) Except for irons having unusual chilling characteristics the probable shape of the mottle zone is a broad inverted V. (5) In chilled castings, including chill-test castings, increasing the pouring temperature increases both chill and mottle depth. In simple sand castings, increasing the pouring temperature should decrease the chill depth. This might not hold good for irons with unusual chilling characteristics. (6) The depth of chill and mottle is a function of casting size and of the relative cooling powers of the sand and chiller walls. In general, it is to be expected that deeper mottle will occur in larger castings.

"A Note on the Influence of Furnace Holding Time on Chill and Mottle Formation" is the subject of a report from Mr. J. Rickard, B.SC. The conclusions he has reached are as follow:—(1) Increasing the time during which a melt was held at 1,390 deg. C. increased the depth of chill and decreased the eutectic cell number. (2) The mottle spread appeared to be little affected by short holding times but when the holding period was increased the mottle widened and also became more coarse. (3) It is probable that the effects of superheating previously reported result from a combination of the effects of superheating temperature and of holding time. (4) The effect of increased holding time and higher superheating temperatures is to eliminate graphite-promoting nuclei in the melt, since both by increasing the holding time and the superheating temperature the eutectic cell number is decreased.

Book Review

Métaux et Alliages d'Addition Utilisés en Fonderie de Métaux Ferreux (Metal and Alloy Additions used in the Ferrous Foundry), compiled by Pierre Détrez. Published by Editions Techniques des Industries de la Fonderie, 12, Avenue Raphael, Paris 16. Price 1,800 francs.

For those having an elementary knowledge of French and a desire to improve the properties of either the iron or steel castings they make, this 100-page paper-backed book will be of absorbing interest. For instance, there is a suggestion that where small size rondelles or cubes of nickel are to be added to a cold charge, they should be placed centrally on the bottom of an over-metal chill and liquid cast iron poured over them. Another gadget that the reviewer has not seen in this country is the placing of an inoculant in a container. Suspended in this is a vertical tube which terminates in a horizontal pipe, one end of which is curved and overhangs the ladle. The other is pressurized, with the bore reduced just on reaching the horizontal tube. This causes a sucking action and ensures the addition arriving in the ladle in a finely divided condition. These are typical examples of a number of potentially useful notions for adding materials to metals. Table I is interesting as it gives the guaranteed carbon content of a wide range of alloys. It is followed by notes as to the amount of fines to be expected in the various grades of alloys. Chapter IV details the outstanding properties to be expected from adding various elements to ferrous foundry products ranging from aluminium to zirconium.

The balance of the book is given over to French sources of supply for metals, alloys and additions, whilst much sound technical information is given in a series of appendices. The reviewer knows of no other book in any language covering this particularly interesting field of metallurgy.

V. C. FAULKNER.

Mr. EDWARD CHARLESWORTH, assistant education officer at the Stocksbridge steelworks of Samuel Fox & Company, Limited, Sheffield, has been appointed education and training officer to the Workington Iron & Steel Company (branch of the United Steel Companies, Limited).

Determination of Colour Differences*

Whenever enamellers meet, and particularly if a member of a spare-parts or selling organization is present, conversation usually turns to difficulties of colour matching. Indeed, it is often said that it is quite impossible to produce identical colours in cast and sheet components of the same appliance. Thus, the article which follows is of general interest. In it, the inaccuracy of the human eye in judging correct colour matchings is revealed and methods for ensuring proper comparison are outlined.

Accurate matching of colours is becoming increasingly important to modern industry. Household appliances such as stoves, refrigerators, washing machines, and clothes dryers, may be assembled from parts produced on different production lines and finished with different materials. A noticeable colour difference between parts may be objectionable to the customer and may adversely affect the sale of the product. Likewise, for many other uses, such as advertising signs, trade marks, traffic lights, and railroad signals, colour is rigidly specified and closely controlled.

For many years, manufacturers and purchasers of coloured materials have employed inspectors to determine whether or not two samples are sufficiently similar in colour to be called a "match." Frequently inspectors cannot agree and, in recent decades, instruments have been developed to measure colour and colour differences precisely. But the extent to which instrumental values of colour differences agree with estimates of human observers is a question that has never been satisfactorily resolved.

Co-ordination

To obtain data which may lead to a solution of this problem, the National Bureau of Standards, in co-operation with the Porcelain Enamel Institute, embarked some years ago on a long-range research programme. Although much experimental work remains to be done, preliminary phases of the investigation have provided significant information on the evaluation of colour differences. This initial stage of the programme has been carried out by Mr. J. C. Richmond, Mr. H. J. Keegan, and Mr. H. K. Hammond of the NBS staff and Mr. R. S. Hunter, director of Hunterlab, with the co-operation of a number of industrial laboratories.

For estimation of colour differences, approximately 200 porcelain-enamel specimens were prepared in 15 groups of 13 panels each. Each group contained one panel which represented the "standard" colour. The other panels of the group represented departures of approximately one and two steps in each of the six directions, *e.g.*, lighter, darker, stronger, weaker, and toward the two adjacent hues.

Shades—a Factor in Match

Thirty-four observers from 10 co-operating laboratories were then asked to estimate, visually, the relative magnitude and most prominent directions of the colour differences between each specimen and the corresponding standard for that group. Nineteen of the observers were classed as experienced, whilst 15 were without experience in colour work.

The data from the two groups of observers were averaged separately and compared. Whilst individual estimates of the colour difference between any one specimen and its standard varied widely, the mean values of colour-difference estimates for inexperienced observers were not significantly different from those who were experienced.

Experience *v.* Neophytes

The statistical scatter of the estimates by the two groups of observers was also about the same. In nine of the 15 sets of specimens, the difference between the statistical scatters, expressed as the average of the geometric standard-deviations, was less than five per cent. In the other six groups, the inexperienced observers had the highest scatter in three colours—brown, grey and purple—and the experienced observers had the highest scatter in the remaining three—fawn, light blue and black.

In general, there was good correlation between experienced and inexperienced observers as regards the size of the statistical scatter for the various colours. Both groups tended to have smaller scatter for the colours near middle grey in the three dimensional colour diagram—such as buff, fawn, dark green, grey, light blue and cream—and larger scatter for the more saturated colours—such as purple, black, orange, brown, red and white. A possible explanation for these trends might be the background against which the specimens were placed for viewing. Although the colour of the background was not specified, it is very likely that in every case it was closer to middle grey than to the saturated colours.

The normal human eye is very sensitive to colour differences and can tell, quite easily, when the two colours match. However, it is much more difficult for the eye to judge the magnitude of departure from a colour match. Colorimeters (Fig. 1), on the other hand, are readily provided with numerical colour scales from which differences may be precisely obtained. However, it is difficult to provide colorimeters with response functions that exactly duplicate those of the eye. Also, the magnitude and direction of colour differences, computed from instrumental data, are functions of the colour difference equation used.

Conclusions

The present investigation, now being carried out, seeks to determine the extent to which colorimeters, now in use, can evaluate colour differences and colour-difference components in a manner which

* Abstracted from an article appearing in the *International Enamellist.*

[*By courtesy of Ferro Enamels, Limited.*

FIG. 1.—*Colorimeter of similar design to that used by the Porcelain Enamel Institute, USA, in the determination of colour differences of enamelled components.*

correlates with human vision. As a first step, the visual estimates of colour difference were plotted against the corresponding instrumental values.

Separate graphs were plotted for the three components of colour differences: hue, lightness, and saturation. For some colours, the correlation between visual estimates and instrumental measurements was quite good, for other colours there was no apparent correlation, and in a few cases there was a suggestion of negative correlation.

The most likely explanation for the cases of poor correlation is simply that the observers were given too difficult a task. That is, the differences were so small that the observers could not agree on the magnitudes or directions of the hue, saturation, or lightness components of the differences.

Whilst the extent to which instrumental measurements of colour difference correlate with visual estimates has not been completely determined, useful conclusions can be drawn from the results obtained thus far. In general, it appears that colour-difference meters, properly operated, are likely to be more reliable than the estimates of a single observer or even a small group of observers.

Correlation of instrumental measurements with visual estimates will probably be satisfactory in most cases, but should be verified for each colour where such correlation is important. However, when differences are less than two NBS units, low correlation may be expected. The numerical size of an instrumentally - measured colour difference will depend on the instrument and the equation used.

The investigation of colour-difference measurement is continuing; present plans call for measurement of the porcelain-enamel specimens with other types of colorimeters. These data, together with those from other sources, should ultimately lead to the development of a simpler and generally more useful equation for computing colour difference.

The spectrophotometer will be used to compile data for each specimen, and these data will also be used to compute the magnitude of colour differences between specimens. Although the spectrophotometer is the fundamental measuring instrument, until recently it had seldom been used to measure small colour differences. Development of analogue computers to automatically integrate spectrophotometric curves has now made this use feasible.

Trade with Bulgaria

By an exchange of letters signed in London on September 27, 1957, the trade arrangement between the United Kingdom and Bulgaria, which was due to expire on December 31, has now been extended until September 30, 1958.

Further detailed arrangements have also been agreed for trade between the two countries from the present time to September 30, 1958. They substantially repeat the arrangements made for the 12 months ending last September, and provide, as before, for Bulgarian purchases of some £2,500,000 of United Kingdom goods, including machinery. The UK market remains open without restriction to imports of many Bulgarian products, including, for example, grains and oil-seeds, and the new arrangements again provide for the issue of import licences for some £1,500,000 of other Bulgarian goods.

Self-help Class

Finding that no classes in foundry practice are organized at technical schools in his area, Mr. C. F. Widmer, general manager, Close Tolerance Castings, Limited, Crawley, Sussex, has taken matters into his own hands in respect of some of his staff. For those of them interested in learning more about their industry, he is to hold a Wednesday evening class at the works from 6 to 8 p.m.; about an hour will be devoted to a lecture and the rest of the time to questions and discussion, with a break for tea in between. It is hoped also to include film shows and possibly works visits in the curriculum. Eight men have so far enrolled—a high proportion of Mr. Widmer's quite small male staff. There are a few vacancies if any foundrymen nearby wish to join the class and Mr. Widmer would like also to hear from any qualified foundrymen willing to volunteer as visiting lecturers.

Railway Engineering Equipment

Increasing Use of Cast-steel Bogies and Automatic Couplings

During the summer meeting of the Institution of Locomotive Engineers, held this year at Buxton, some 90 members toured the works of English Steel Castings Corporation, Limited, and of English Steel Spring Corporation, Limited, both subsidiaries of English Steel Corporation, Limited. The party was headed by the Institution's president, Mr. J. F. B. Vidal, and welcomed by Dr. C. J. Dadswell, managing director of the two ESC subsidiary companies concerned.

Castings *v.* Steel Fabrications

In the works of the Castings Corporation was seen what is considered to be the biggest range and variety of steel castings made by any one company in the world. There were castings weighing from a few pounds to over 150 tons, in a works where the heaviest castings made have been 185 tons. Within this range of castings are many specially designed to replace the fabricated forms of construction. Cast structures, properly engineered for this purpose, possess, it is claimed, a greater rigidity for equivalent weight compared with fabricated structure, whether riveted or welded. Built-up structures subjected to dynamic forces—which are rarely, in a railway vehicle, of a simple form—having complex-stress diagrams, seldom last indefinitely. It is considered that a properly engineered cast-steel structure, on the other hand, has an indefinite life, requiring no maintenance through joints loosening or breaking. The cast structure also has a better resistance to corrosion. Experience in railways all over the world using castings for bogies has proved that they are not a fashion but a necessity. Castings are sometimes more expensive initially, but remain trouble free for many years. Cast-steel bogies have been made for less than 10 years, and intensively for the past three years, but even so over 1,000 bogie frames have been supplied. Moreover, although in the past 25 years over 50,000 Davis & Lloyd type cast-steel side-frame and bolster-type bogies for wagons have been supplied, in no single instance has one been broken due to service conditions.

One-piece cast-steel bogies (Fig. 1) are made to "Commonwealth" design in collaboration with General Steel Castings Corporation of America, and passenger bogies for the CIE-Irish Transport Company. There are prototype passenger bogies running on British Railways at the present moment and diesel electric locomotive bogie frames. A considerable amount of money has been invested in plant to make these castings because of confidence in an increasing demand. Their initial cost may be more than a fabricated bogie, but the fact that railway after railway is standardizing on this form of construction is proof that a great contribution is being made to railway engineering progress. A one-purpose, moulding and sand plant for making bogies, recently installed and the latest of its type in Great Britain, has cost a quarter of a million pounds. Machine tools to the same value are already being delivered to a new machine shop being built, and a similar sum for further machine tools is to be spent.

Automatic Couplings

Various forms of automatic couplers are made for both railway and industrial purposes. Since the war some 40,000 automatic couplers have been sold to the National Coal Board for mine cars, to increase safe operation of haulage below ground. In the last 30 years, 350,000 automatic couplers for railway purposes have been supplied

FIG. 1.—*Visitors, of the Institution of Locomotive Engineers, inspecting one-piece cast-steel bogie frames of the "Commonwealth" type.*

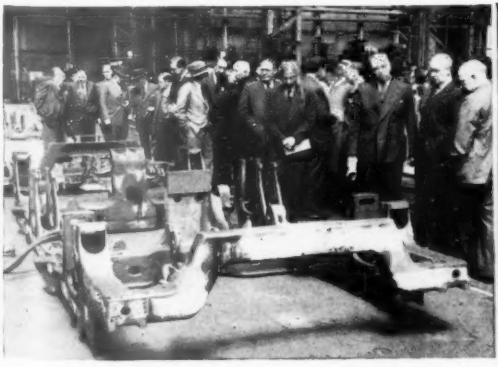
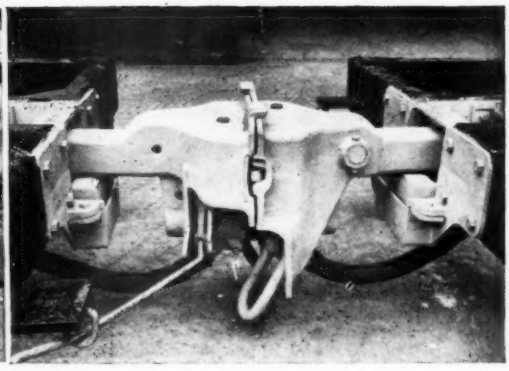


FIG. 2.—*Close-up of the prototype of cast-steel automatic coupler, with integral vacuum-brake connection.*



Railway Engineering Equipment

all over the world. At the present moment the AAR Type "F" interlocking-type couplers with rubber draft gears are being made for 90-ton ore wagons in India.

The latest coupler developed has been submitted to British Railways for their wagons. This coupler is capable of connecting automatically both the draw-bar (for buff and draw) as well as the vacuum connection. The design has been worked out in collaboration with Gresham & Craven, Limited, in developing the automatic vacuum connector and with the Westinghouse Air Brake & Signal Company, Limited, in developing the automatic air-line connector. (See Fig. 2.)

Law Cases

"Anthology of Pneumoconiosis Cases"

In the latest of what he described as "an anthology of cases concerned with pneumoconiosis," Lord Wheatley in the Glasgow Court of Session has awarded £4,292 damages to Mr. George O'Neill (47), a Kirkintilloch ironfoundry dresser. He held that Mr. O'Neill, who sued Cameron & Roberton, Limited, South Bank Ironworks, Kirkintilloch, for £7,000, contracted the disease and 80 per cent. of his incapacity was attributable to the fault of his employers between 1943 and 1953.

Lord Wheatley said it was disclosed that before 1943 the plaintiff was employed in a number of jobs at which he might have been exposed to the inhalation of the dangerous siliceous particles which constituted the build-up of the disease in the lungs.

The defendants had submitted that Mr. O'Neill might well have contracted the disease before he entered their employment; or, if he was subjected to the inhalation of noxious particles while in their employment, this could only have aggravated an already established condition.

The plaintiff replied that the degree of aggravation must have been substantial. His work had consisted of cleaning castings with a hammer and chisel, but he also took his turn operating plough buffs on heavy castings, and his duties included also cleaning out the dust from a shotblasting machine.

Lord Wheatley held it established that there was a continuous breach by the defendants over a period of years of a regulation under which they were obliged to fit dust-extraction plant to plough buffs, and that such breach had a causal effect upon the plaintiff contracting the disease. It was conceded by the defendants' counsel that such a conclusion was sufficient for the determination of liability.

Mr. O'Neill was awarded £1,120 for loss of wages, £2,252 for loss of future wage-earning capacity, £600 for pain and inconvenience, and £320 for loss of expectation of life.

Glasgow Firm Fined

Four men—an engineering fitter, two policemen, and a doctor—were required to release a man whose arm was caught in a convevor belt at the Tubal Works of Shanks & Company, Limited, sanitary engineers and ironfounders, of Barrhead, Glasgow. At Paisley Sheriff Court the company was fined £20 for failing to fence a dangerous part of a machine.

For the prosecution it was stated that work had finished in the ironfoundry and the man who was injured was attending to the plant to ensure that it was in good working order for the nightshift. He noticed that the feed belt for conveying sand was running off-centre. His right hand was caught between the belt and the drum on which it turned.

A representative of the company said that it was deeply concerned that such an accident had taken place and that the part of the machine was not securely fenced. The injured man, a competent and experienced engineer, had apparently inserted his hand to remove grit.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

778,597. Ford Motor Company, Limited, 88, Regent Street, London, W.1.

A process for the manufacture of sound nitrogen-rich austenitic alloys which are fully and stably austenitic and which require the utilization of greatly reduced amounts of nickel and in some situations permit the total elimination of this element. A nitrogen content of 0.3 to 10 per cent. is quoted, and the statement is made that the usually unwanted ebullition of nitrogen during solidification of an ingot from a melt is permitted to occur. At least part of the nitrogen thus freed being trapped in the solidifying ingot and later redissolved and a sound ingot produced.

778,848. Spencer and Halstead, Limited, Bridge Works, Ossett, Yorks, and William Male Oddie.

Abrasive treatment of metallic articles, particularly for cleaning, polishing, hardening or otherwise treating the surface of castings. The apparatus is one in which an abrasive stream can be readily interrupted at desired intervals in the processing cycle, so that the batch of articles after treatment can be treated to remove the abrasive material from them.

778,863. Schueler Automatic Foundry Processes, Limited, Old College Works, Tideswell, nr. Buxton.

The production of hollow sand cores and hollow sand-mould units for casting. The invention is a modification of an older patent, No. 735,355.

778,973. Fairbairn Lawson Combe Barbour, Limited, Wellington Foundry, Leeds, 1, Yorks.

A shell-moulding machine for economical production of shell cores. It can be readily employed also for the manufacture of shell moulds. Each corebox may be replaced by a pattern, and the reservoir by a dump box, thus enabling shell moulds of extended surface to be produced.

778,980. Gesellschaft fur Huttenwerksanhagen m.b.H., 105, Kaiserwertherstrasse, Düsseldorf, Germany.

A method of producing steel in a Siemens-Martin furnace. A hot-iron melt (1,400 to 1,600 deg. C.) low in manganese, silicon, and sulphur, is produced in a hot-blast, neutral or basic-lined cupola. The solid charge (scrap and a refining agent, such as mill-scale) of the Siemens-Martin furnace is initially melted and the iron then introduced and refined.

778,998. Foster Wheeler, Limited, Foster Wheeler House, 3, Ixworth Place, London, S.W.3.

An improved permanent mould for casting surface elements such as fins, on to a tube. It comprises two complementary sections shaped to receive a length of the tube axially between them as a core to the mould, and has an inlet for molten metal arranged so that the metal entering the casting cavity impinges against the upper surface of the tube and passes down around the tube in contact with it. A trough for receiving excess metal is placed below the casting cavity.

Company News

MANGANESE BRONZE & BRASS COMPANY, LIMITED—The directors have decided that the proposed 100 per cent. scrip issue will be made to holders of October 14 and not October 23.

STEWARTS AND LLOYDS OF SOUTH AFRICA, LIMITED—A higher dividend of 20 (17½) per cent. is recommended for the year to June 30. Group net profit rose from £891,308 to £1,009,354 after tax.

WILLIAM JACKS & COMPANY, LIMITED—An extraordinary meeting is called for October 23 to create 2,200,000 5s. ordinary shares and to effect the one-for-two scrip issue to holders of October 23.

ANTI-ATTRITION METAL COMPANY, LIMITED—The offer by Beyer, Peacock & Company, Limited, to acquire the capital has been accepted by about 80 per cent. of the company's shareholders. The offer closes on October 27.

DUNLOP RUBBER COMPANY, LIMITED—The company announces an increase in its interim dividend from 2½ to 3 per cent. in respect of 1957. The final payment for 1956 was 7½ per cent. Group net profit from trading, and before depreciation, interest, and tax, rose from £5,730,000 to £9,420,000.

VILLIERS ENGINEERING COMPANY, LIMITED—Ordinary shareholders have subscribed for 10 per cent. of the issue of 600,000 6 per cent. convertible debenture stock 1972-77. The underwriters are required to take up the remaining 90 per cent. of the stock in accordance with their commitments.

H. W. LINDOP & SONS, LIMITED, malleable ironfounders, of Walsall (Staffs)—The dividend for the year ended June 30 is raised to 35 (30) per cent. with a final of 25 (20) per cent. CIC consent has been obtained for a one-for-two capitalization issue. Group profits advanced to £31,076 (£18,928).

LAKE & ELLIOT, LIMITED, steelfounders, of Braintree (Essex)—The 7½ per cent. final dividend (making a total of 12½ per cent. for the year to July 31, 1957) is an effective increase of 2 per cent. on the similar total for the previous year, when there was a two-for-three scrip issue between interim and final. Group net profits increased by some £30,000 to £238,140 (£208,153).

E. C. & J. KEAY, LIMITED, steelworkers and founders, etc., of Henley-in-Arden (Warwickshire)—Negotiations have been completed for the purchase of the company's capital by N. Hingley & Sons, Limited, of Dudley (Worcs), which carries on a similar line of business. The purchase price will be satisfied by allotment to shareholders of 200,000 10s. stock units in N. Hingley and payment of £100,000 in cash.

RANSOME & MARLES BEARING COMPANY, LIMITED—According to Mr. E. W. Senior, chairman, the order-book is in a "very satisfactory state" and turnover is higher. Despite the fact that it has been made clear that the credit squeeze will be intensified and that investment must be matched by savings, he looks forward with "cautious optimism" to the current year's results. Group net profits increased by £11,773 to £411,905 with a repeated distribution of 15 per cent.

QUALCAST, LIMITED—Operating results for the current year are rapidly approaching the 1955-56 record level. The plant is again running at capacity and means to increase production are being sought, states the chairman, Mr. J. E. V. Jobson. In the year ended June 30, profits, before tax, fell 31 per cent. to £547,283, mainly because of increased raw materials prices, wages awards, the recession in the automobile trade, and the engineering strike. To establish a steady rate of payment which should not be unduly affected by temporary variations in earnings, the dividend is being maintained at 24 per cent.

CROSSLEY BROS., LIMITED, makers of diesel locomotives, marine and gas engines, of Manchester—The narrowing margin between prices obtained in export markets and payments in wages and salaries, and the switch of manufacturing programmes to other orders following the loss of Middle East markets due to the Suez trouble, were two major problems confronting the company, states Sir Kenneth Crossley, in his annual review. The dividend is unchanged at 12 per cent., but group profit before tax declined to £390,737 (£443,634). Sir Kenneth points out that the company has no connection with Crossley Motors which has been reported as closing down.

Dosco Stock Transfer

A court action to prevent the proposed purchase of the Dominion Steel & Coal Corporation, Limited, by A. V. Roe (Canada), Limited, has been started by Mr. C. Eaton, who states he is acting on behalf of the Dosco shareholders' protective committee. He has filed a writ seeking court orders stopping share and debenture transfers and debenture conversion to ordinary shares, and he is seeking a court declaration that Dosco shareholders have no contract to sell out to Avro.

On October 3, Mr. R. Williams, assistant to Mr. Crawford Gordon, president of Avro (Canada), said the writ had in no way affected the carrying out of the share exchange now going on. "We see no possibility that it will stop any of the Dosco shares now deposited, or that may be deposited in future, from being converted," he said.

Smith & Wellstood Reorganization

Final dividend of Smith & Wellstood, Limited, Bonnybridge ironfounders, etc., has been increased to compensate for the reduced interim giving a total of 9 per cent. (same). The parent company experienced very difficult trading conditions, due principally to the fall in sales to Australia and Eire which arose from quota restrictions in Australia and additional tariff levies in Eire. The company also again had to contend with rising costs caused by wage awards and rises in the cost of coal and transport, iron and steel, and other materials.

Reorganization has, however, resulted in economies in fixed overheads and other costs, partly offsetting the loss of profits caused by reduced output, and has improved results in recent months.

Allis-Chalmers' Forms New Division

A new major operating division, Allis-Chalmers International, has been formed by Allis-Chalmers, US manufacturers of industrial earth-moving equipment. Mackay Industrial Equipment, Limited, Feltham (Middx), the sole distributors in the UK for Allis-Chalmers equipment, has been informed that the new division will be responsible for all Allis-Chalmers operations and activities outside the US and Canada.

Mr. P. F. Bauer has been appointed managing director of Allis-Chalmers International, with Mr. F. J. Mischke and Mr. Paul Dietz as associate directors of sales, and Mr. C. G. Crozier as territory manager, distributor products, Europe and north-west Africa.

News in Brief

LEYS MALLEABLE CASTINGS, LIMITED, Derby, are to give a free luncheon once a month to their retired employees.

STAVELEY IRON & CHEMICAL COMPANY, LIMITED, has opened a new office and stockyard for the South-Western area, at Denver Road, Topsham, near Exeter.

GRIFFIN & GEORGE, LIMITED, announce that the address of their sales office and warehouse for the Birmingham area is now Frederick Street, Birmingham, 1.

A SIX-WEEKS' DRIVE in factories to collect a quarter of a million tons of scrap iron for the country's foundries has been launched by the ministry for heavy industry in Hungary.

ON OCTOBER 7, as part of their scheme for extension and modernization, Newtons (Ironfounders), Limited, of Manchester, opened a new ablution and toilet centre costing over £10,000.

S. GUITERMAN & COMPANY, LIMITED, manufacturers of machine tools, electrical appliances, etc., of London, W.1, has taken over the old-established departmental store of J. Grice, Limited, Leicester.

CAMBRIDGE INSTRUMENT COMPANY, LIMITED, 13, Grosvenor Place, London, S.W.1, are showing a wide range of their control instruments at the forthcoming Interkama Exhibition in Düsseldorf, November 2 to 10.

A NEW WATER TOWER to cool its Siemens furnace has been erected by Thos. Firth & John Brown, Limited, Sheffield. It supplies water at the rate of 2,500,000 tons every 24 hours, and has a capacity of 138,000 gallons.

PLASTICS MACHINERY and high-pressure fittings worth £54,000 have been ordered from the Burtonwood Engineering Company, Limited, Warrington (Lancs), by the Royal Dutch State Mines. The equipment is for the manufacture of polythene.

WINSTON ELECTRONICS, LIMITED, Shepperton (Middx), has been appointed sole agent in the UK for a number of industrial electronic-control instruments manufactured by Beckman Instruments, G.m.b.H., Munich, and Beckman Instruments, Inc., Fullerton, California.

A SHARE in the Davy & United Engineering Company, Limited, Sheffield, formerly owned by the late Mr. John Walter Hurt, a foreman patternmaker, has been returned to the company by the family and sold for the benefit of the firm's sports and welfare fund.

F. & M. SUPPLIES, LIMITED, 4, Broad Street Place, London, E.C.2, announce they are now carrying stocks of most of the company's products in the following centres:—Manchester, Glasgow, Sheffield and Birmingham, as well as London, where these are manufactured.

NEW ORDERS booked for British machine tools in July were the highest for four months. The value of orders outstanding fell for the eleventh month in succession. Home deliveries in July were valued at £5,900,000, against £5,490,000 in June, while exports totalled £2,110,000 (£1,990,000).

SOLUS-SCHALL, LIMITED, 15, Clipstone Street, London, W.1, have received a contract from Taylor Woodrow, Limited, to carry out gamma radiography on a 10-in. pipeline from Port Hardcourt, in Nigeria, to Oloibiri, near Kuglo, 60 miles away. The project is scheduled for completion at the end of January, 1958.

THE Electro-Chemical Engineering Company, Limited, has opened a new depot at Chaddock Lane, Astley, near Manchester (telephone: Atherton 1364). The manager is Mr. H. Maxwell. Stocks of chemicals and Efco-Udylite products will be maintained and it is planned to have laboratory facilities available in due course.

WOLF ELECTRIC TOOLS, LIMITED, London, announce the appointment of Mr. H. A. Herzogenrath as sales representative to develop sales of portable power tools on the Dutch market. He is working closely with the long-established Wolf agents there, Joh. Westhof Im-En Export Mij., N.V., Dr. Kuyperstratt 23, The Hague.

AN EXHIBITION CALLED INTERKAMA covering measuring instruments and automation is being organized by Nordwestdeutsche Ausstellungs-Gesellschaft m.b.H., to take place in Düsseldorf from November 2 to 10. The same firm organized the foundry exhibition in that city last year. Details are available from John E. Buck & Company, Limited, 47, Brewer Street, London, W.1.

MR. H. A. WINCER, the Author of the paper on malleable production at Ransomes, Sims & Jefferies, Limited, printed in last week's issue, points out that to be strictly in conformity with the text, sections (*a*) and (*c*) of the photomicrographs making up Fig. 5 should be transposed. Apologies are made for this error in mounting the pictures for reproduction.

EXPORTS from the Doncaster works of the International Harvester Company of Great Britain, Limited, were 75 per cent. higher in the first 10 months of the present financial year than in the same period a year ago, according to Mr. O. G. Voss, managing director. Most of this new business was the result of the introduction of the B-250 tractor. Domestic business was 27 per cent. ahead of the same period last year.

THE SEPTEMBER ISSUE of the *Nickel Bulletin*, published by the Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1, carries six abstracts of articles covering cast iron. In one of French origin it is shown that the accidental presence of nickel in cast iron when used in association with the dry enamelling process is devoid of any deleterious effect. This useful *Bulletin* is available free of charge to readers, if they write to Thames House.

DEMAG AKTIENGESELLSCHAFT announce that the agency in the United Kingdom of Great Britain and Northern Ireland for products of their iron and steel plant and the crane divisions, as well as of the subsidiary, Demag-Elektrometallurgie G.m.b.H., has been transferred to Mr. Boris Ryman, 56, Curzon Street, London, W.1 (Telephone: GROSVENOR 4121). The agreement with the previous agents, D.M.M. (Machinery), Limited, was terminated on September 30.

A TWIN-SCREW passenger and cargo ship of 1,500 tons displacement, for service on Lake Victoria, East Africa, has been ordered from Yarrow & Company, Limited, Glasgow, by the Crown Agents. The machinery will be supplied by Crossley Bros., Limited, Manchester. Another Clyde shipbuilding concern, George Brown & Company (Marine), Limited, Greenock, has received an order from the Blue Star Line, Limited, for a shelterdeck type motor coasting vessel of 1,700 tons.

THE APPEAL FOR £200,000 which was launched by the board of governors of Paisley Technical College for the provision of additional training facilities has been given generous support by large and small industrial firms. Subscriptions so far total £150,000. When the College was designated a central institution under the national plan to provide Scotland with the most advanced levels of scientific and technological educa-

tion, extended facilities in both buildings and equipment became essential.

AN 1888 1½ H.P. BENZ MOTOR-CAR has been entered by the Science Museum in the commemoration run from London to Brighton on November 3. This three-wheeled vehicle is the oldest petrol-engined car in this country and the fifth oldest commercially produced car in the world. It was made by Carl Benz at Mannheim and was sold through Emile Roger, his French agent, and probably came to England in the early 1890's. This 1888 Benz car, which is the most historically important item in the National Road Transport collections, was purchased by the Science Museum in 1913.

THE BOARD OF TRADE ANNOUNCE that Mr. Ephraim I. Shamash, Rashid Street, Bagdad, will arrive in London about the middle of October. Mr. Shamash is interested in obtaining new agencies for heating and cooking stoves, bicycles, gramophone records and record-players, ceiling fans, and domestic electrical equipment generally. Suppliers interested in this enquiry should write to Mr. Shamash, c/o Export Services Branch, Room 745, Lacon House, Theobalds Road, London, W.C.1, quoting reference ESB/24130/57. They are strongly urged to send copies of their letters to this Branch, so that the staff may assist in arranging for Mr. Shamash to call on them.

THE RIVER DON WORKS of the English Steel Corporation, Limited, Sheffield, were toured by Lord Brookeborough, the Prime Minister of Northern Ireland, on Friday, October 11. He was the guest of Sir Frederick Pickworth, Master Cutler and chairman of ESC. He saw the Hawke Street machine shop, the steel foundry and the heavy machine shop. He was accompanied by Mr. W. D. Pugh, managing director, Mr. C. Muirhead, special director, Mr. L. R. Evans, superintendent of English Steel Castings Corporation, Limited, and Mr. H. Cowlishaw, superintendent of heavy-plate products. After the tour he lunched with Sir Frederick and was afterwards taken on a conducted tour of the Cutlers' Hall.

Board Changes

ALFRED HERBERT, LIMITED—Mr. G. S. Townsend has resigned his directorship.

WILLIAM SUGG & COMPANY, LIMITED—Mr. R. H. Norman has been appointed a director.

POWER SECURITIES CORPORATION, LIMITED—Mr. Eric H. Ball has been appointed a director. He is managing director of the British Thomson-Houston Company, Limited.

SHEEPBRIDGE ENGINEERING, LIMITED—Lord Aberconway has been appointed chairman, succeeding Mr. A. V. Nicolle, who has resigned on reaching the age of 65. Mr. Nicolle is remaining on the board.

GENT & COMPANY, LIMITED—Mr. S. A. Clarke has been appointed joint managing director. Mr. Clarke, who joined the company in 1910, was appointed a director in 1952 after being progress manager for many years.

BRITISH ALUMINIUM COMPANY, LIMITED—Mr. G. A. Anderson, Mr. W. B. C. Perrycoste, and Mr. J. Salter have been appointed additional executive directors. Mr. Anderson becomes director and general sales manager, Mr. Perrycoste, director and general production manager, and Mr. Salter, director and general production manager. Mr. G. W. Lacey, at present director in charge of sales, will assume the title of commercial director. To facilitate these appointments Mr. W. H. Harrison and Mr. E. Holland-Martin have relinquished their directorships.

Changed Pattern of Dowty Group Production

During the past 10 years the Dowty Group, Limited, makers of mining, aircraft, and general hydraulic equipment, of Cheltenham (Glos), ploughed back into the business £2,600,000 and in the year ended March 31, raised £1,500,000 by a loan stock issue. In recent years, states Sir George Dowty, chairman, in his annual review, a good deal of capital expenditure has been for research and development and additional finance may be required to provide further production facilities.

Over the past six years turnover has been more than trebled. Ten years ago aviation sales represented 94 per cent. of the total; now they constitute only 40 per cent. Today the company's largest activity was the provision of mining equipment, aircraft was secondary, and then came railway and nuclear equipment, the latter activities being in their comparative infancy. The production of pitprops had been still further mechanized and it was believed that the company's plant was the most advanced in the world for the mass production of mining equipment.

Last year's development programme resulted in an increase of £379,344 in fixed assets to £2,334,354. Following the loan stock issue, net current assets rose by £1,819,434 to £4,051,318. Group profits expanded from £1,495,191 to £1,651,580 in 1956-57, and the tax free dividend is raised from 7½ per cent. to 9 per cent.

B. Elliott & Company's Debenture Plan Deferred

"In view of the market repercussions following the raising of the Bank rate," B. Elliott & Company, Limited, machine-tool manufacturers, of London, N.W.10, has decided that it is no longer opportune to proceed with the proposed £300,000 privately-placed debenture issue. This decision necessitates the postponement for the time being of the redemption of the redeemable cumulative second preference shares and the purchase of the entire share capital of Newcast Foundries, Limited, Silverdale (Staffs).

The directors will, however, proceed with the proposed issue of 2,700,000 1s. ordinary shares on the original basis of 3s. per share in the proportion of one new share for every two held on October 21. Another extra-ordinary meeting has been called for October 28 to approve the creation of 6,600,000 ordinary 1s. shares, and this will leave a reserve of 3,900,000 shares available for issue "whenever favourable opportunities arise in the future."

The directors state that if current trading conditions continue, earnings will permit last year's dividend rate of 30 per cent. to be maintained on the increased share capital for the year to March 31, 1958.

Minibition Awards

At the "Minibition" held last month at the Metropole Hotel, Folkestone, in conjunction with the annual conference of the Purchasing Officers Association, the following were named prizewinners: *Display Class:* 1st prize: Langley London, Limited; 2nd prize: Mavor & Coulson, Limited, and 3rd prize: Standard Telephones & Cables, Limited. *Education Class:* 1st prize: Shell Mex and B.P. Limited (one award only).

Imports and Exports of Iron and Steel in August

The following tables, based on Board of Trade returns, gives figures of imports and exports of iron and steel in August. Totals for the first eight months of this year and last are also included.

Total Exports of Iron and Steel

Destination.	Month ended August 31.	Eight months ended August 31.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Channel Islands	229	3,299	2,445
Cyprus	451	4,416	8,244
Sierra Leone	1,644	5,505	9,742
Ghana	2,305	16,593	16,412
Nigeria	5,852	38,880	39,874
Union of South Africa	11,307	47,797	76,700
Rhodesia and Nyasaland	6,167	58,856	46,612
Tanganyika	2,363	16,232	15,938
Kenya	5,772	32,339	36,255
Uganda	249	3,327	2,716
Mauritius	254	2,418	2,373
Aden	233	4,264	2,978
Bahrein, Qatar, and Trucial States	2,308	7,353	10,951
Kuwait	3,978	4,875	23,412
India	15,516	203,312	177,976
Pakistan	4,267	33,307	43,286
Singapore	1,431	20,567	26,179
Malaya	1,215	24,600	23,696
Ceylon	1,224	21,852	19,128
British North Borneo	215	4,239	2,576
Hongkong	4,002	39,954	60,302
Australia	11,696	142,812	135,094
New Zealand	19,410	124,361	140,591
Canada	19,927	199,457	193,644
Jamaica	1,600	15,949	15,652
Trinidad	5,934	25,325	33,073
British Guiana	944	3,415	5,140
Other Commonwealth countries	1,597	18,688	20,082
Eire	2,301	45,858	27,957
Finland	7,670	36,219	60,201
Sweden	7,488	77,668	73,132
Norway	5,713	56,718	74,618
Denmark	8,087	51,160	74,131
Western Germany	433	6,791	6,060
Netherlands	3,673	57,864	70,707
Belgium	7,088	22,992	31,243
France	745	5,272	12,782
Switzerland	801	9,068	12,104
Portugal	1,182	6,834	13,429
Spain	2,655	20,161	28,871
Italy	2,859	12,310	34,355
Austria	614	2,980	3,560
Yugoslavia	506	5,268	6,558
Greece	1,579	3,778	7,719
Turkey	176	2,926	3,796
Netherlands Antilles	111	6,383	2,391
Portuguese East Africa	511	2,096	3,359
Egypt	1,109	33,916	1,578
Sudan	1,514	9,200	12,563
Lebanon	3,354	4,853	8,051
Israel	192	5,935	3,147
Saudi Arabia	343	8,411	3,120
Iraq	3,198	22,437	30,338
Iran	5,311	45,402	44,783
Burma	2,965	5,580	17,463
Thailand	831	4,636	5,696
Indonesia	75	7,573	5,427
Philippine Republic	1,633	4,626	3,390
USA	4,023	35,491	35,340
Cuba	356	5,718	6,062
Colombia	650	2,705	4,540
Venezuela	9,575	47,337	77,852
Ecuador	357	2,704	2,009
Peru	2,106	10,613	8,832
Uruguay	622	3,221	5,397
Argentina	7,586	36,639	55,160
Other foreign countries	12,900	36,545	98,715
TOTAL	244,982	1,889,880	2,167,507

A CONTRACT for the reconstruction of bridge No. 30, Friezland and Uppermill Stalybridge and Saddleworth Line, has been placed with the Butterley Company, Limited, of Ripley, by British Railways (London Midland Region).

Total Imports of Iron and Steel

From	Month ended August 31.	Eight months ended August 31.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	670	2,324	3,326
Canada	2,208	40,289	32,641
Other Commonwealth countries, and Eire	2,684	5,162	17,559
Soviet Union	22,022	207,271	185,862
Sweden	2,005	31,063	20,580
Norway	7,213	67,363	76,225
Western Germany	5,848	150,144	71,812
Netherlands	7,410	70,682	39,540
Belgium	11,382	272,539	107,980
Luxembourg	999	45,600	18,871
France	3,417	180,077	42,966
Italy	235	8,612	2,840
Austria	2,688	111,909	51,244
Japan	1,220	11,959	9,961
USA	33,868	349,349	188,615
Other foreign countries	1,727	52,119	24,940
TOTAL	105,596	1,606,462	894,962
Iron and steel scrap and waste, fit only for the recovery of metal	40,136	736,301	531,300

Exports of Iron and Steel, by Products

Product.	Month ended August 31.	Eight months ended August 31.	
	1957	1956	1957
	Tons.	Tons.	Tons.
Pig-iron	9,177	77,999	84,641
Ferro-columbium (niobium)	5	116	75
Ferro-tungsten	15	757	380
Other ferro-alloys	347	2,819	2,268
Ingots, blooms, billets, slabs, sheets, and tinplate bars	101	1,244	881
Iron bars, rods, angles, shapes, and sections	200	1,512	1,358
Steel bars, rods, angles, sections, and shapes	36,991	309,076	361,460
Iron plates and sheets	300	142	305
Universal plates	408	2,963	4,516
Steel plates, ⅛ in. and under ¼ in.	739	6,353	8,598
Do., ¼ in. and over	10,519	152,678	126,128
Blacksheets and blackplate	30,127	149,530	229,032
Hoop and strip	5,267	58,996	63,874
Tinplate	28,107	198,632	277,157
Decorated tinplate	246	4,360	3,603
Galvanized sheets	19,583	103,139	142,303
Other (including tinned sheets, terneplate, and ternesheets)	811	10,112	13,270
Railway and tramway construction material	22,367	190,464	182,304
Wire rods	4,435	26,585	39,705
Wire	8,346	63,358	74,245
Tubes, pipes, and fittings	65,656	523,742	542,465
Iron castings	104	1,453	1,204
Steel castings	315	1,220	1,909
Forgings	816	2,630	5,736
TOTAL	244,982	1,889,880	2,167,507

Mr. H. J. HADOW took up his appointment as secretary of the National Physical Laboratory on October 1. Mr. Hadow, who has been scientific attaché at the British Embassy in Washington, has been a director of the UK scientific mission there since 1954. He joined the Department of Scientific and Industrial Research in 1951 where his work was primarily concerned with the research associations.

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Personal

Mr. R. L. WEBSTER, chief personnel manager of Hoover, Limited, has been elected president of the Institute of Personnel Management.

Mr. PERCY HOPKINSON, managing director of British Furnaces, Limited, of Chesterfield, has returned from a four-month business visit to Australia.

Mr. KENNETH H. WATKISS has been appointed chief accountant to Geo. Salter & Company, Limited, West Bromwich, in succession to Mr. W. D. BUTLER.

Mr. A. H. THOMAS, the newly-elected chairman of the Purchasing Officers' Association, is chief buyer of British Belting & Asbestos, Limited, Cleckheaton.

Mr. C. F. PAGNAMENTA, O.B.E., A.C.A., has been appointed chief accountant of Guest Keen Iron and Steel Company, Limited, and its subsidiaries as from October 1.

Consolidated Pneumatic Tool Company, Limited, announce the appointment of Mr. G. M. KEIGHTLEY as manager of their British sales division with Mr. R. E. BAYLISS as assistant manager.

Head of the British Thomson-Houston Company's industrial sales department in London since 1942, Mr. R. A. R. BOTTONE has retired from the company's service. His successor is Mr. F. C. LUCAS.

Mr. J. A. SMITH (chief accountant) has been appointed commercial director, and Mr. H. C. MCINTYRE works director of the North-Eastern Marine Engineering Company, Limited, Wallsend, Tyneside.

Raleigh Industries announce that the following additional members have been appointed to its new management group:—Mr. A. HUFFEY (depot inspector), Mr. H. T. FINCH (superintendent, No. 2 factory), Mr. L. S. DARBY (superintendent, lamp shop), and Mr. C. DODMAN.

Sir GEORGE TURNER has joined the board of Stothert and Pitt, Limited. He is a director of the Goodyear Tyre and Rubber Company (Great Britain) Limited, and a member of the South Western Electricity Board. Mr. E. STANLEY FRANKLIN has retired from the board after 43 years with the company.

Mr. OSWALD BELL has retired from his post as technical manager of the general engineering division of Head, Wrightson & Company, Limited, Thornaby-on-Tees. Mr. Bell, who joined the company 50 years ago as an apprentice in the drawing office, received presentations of a cheque and a pair of binoculars.

Mr. L. LEWIN, head of the communications department of Herbert Morris, Limited, of Loughborough, was presented with a wallet, and a refrigerator to mark his 50 years' service with the firm. The gifts were presented by the vice-chairman of the company, Mr. H. G. PURNELL, in the absence of Mr. FRANK MORRIS, the chairman.

Last Friday, Professor F. C. THOMPSON delivered his inaugural address as president of the Manchester Association of Engineers. He is one of the few metallurgists who has occupied the chair of this important Association, and the theme of his address was the relative stability of metals. Professor Thompson is shortly relinquishing the Chair of Metallurgy at Manchester University and was recently honoured by his past students at a social function.

J. Rastall & Son, Limited, engineers and brass founders, of Manchester, announce that Mr. R. K. JACKSON has joined their staff in the capacity of foundry manager. Mr. Jackson was awarded the 1950 Institute of British Foundrymen's Students' Grant to attend the National Foundry College at Wolverhampton, and after the first year was granted a progress scholarship which enabled him to complete the Diploma Course in 1952. He is well known in Lancashire foundry circles as the secretary of the IBF Burnley section.

Mr. H. L. SATCHELL has been appointed director of manufacture of British Thomson-Houston, Limited. He succeeds Mr. W. W. VINSEN, who is to retire from the board at the end of the year. Mr. Vinsen first joined the company in 1913. He was appointed to the board as assistant director of manufacture in 1945 and later in the same year became director of manufacture. Mr. Satchell started with BTH in 1920. He has been a director since 1949 and deputy director of manufacture since 1955.

At the annual general meeting of the British Internal Combustion Engine Research Association the Rt. Hon. the VISCOUNT FALMOUTH was re-elected president of the Association. Sir HAROLD ROXBEE COX and Professor O. A. SAUNDERS were re-elected as vice-presidents. Vice-Admiral N. E. DALTON (Engineer-in-Chief of the Fleet), Mr. H. N. PEMBERTON (chief engineer surveyor, Lloyd's Register of Shipping) and Brigadier S. A. STEWART (director, royal engineer equipment, Ministry of Supply) were also elected as vice-presidents. Mr. B. D. GIORDAN and Mr. C. G. TANGYE were elected to the Council in succession to Mr. J. CALDERWOOD and Mr. V. H. HOPKINS. Mr. A. C. YEATES has succeeded Mr. G. W. BONE as chairman of Council, and Mr. GIORDAN has been elected vice-chairman.

The following appointments have been made in the Horseley Bridge & Thomas Piggott Group:—Mr. R. J. FOWLER, chief engineer of the parent company, has been elected an executive member of the board and will be known as technical director. Mr. JAMES S. CHRISTIE has been appointed managing director of the subsidiary, Mechans, Limited, and will remain as joint managing director of the parent company. Mr. VINCENT SENIOR has been appointed chairman and Mr. B. VINCENT SMITH managing director of the subsidiary, Carter-Horseley (Engineers), Limited. Mr. NORMAN GIBB, Mr. R. W. DEWAR, Mr. A. GORDON OSBORNE, Mr. E. W. SALT and Mr. J. H. WILLCOX have been appointed local directors of the same subsidiary. Mr. A. LESLIE LIGERTWOOD, secretary of Mechans, also becomes secretary of Horseley Bridge & Thomas Piggott.

Obituary

Following a short illness, Mr. B. W. LIVERMORE, a director of Keith Blackman, Limited, died on October 7. Mr. Livermore, although in his 72nd year, was still a very active member of the board, which he joined in 1948, and prior to his retirement as a full-time executive in 1955, had served the company for 51 years.

Mr. JOHN FRANCIS PHILLIPS, joint managing director of the Universal Grinding Wheel Company, Limited, Stafford, died on October 5 at the age of 52. He joined the company in 1926. Mr. Phillips was appointed joint managing director in 1942, and among his other posts was that of chairman of the Allied Trades Section of the Machine Tool Trades Association.

Mr. J. H. C. SPINKS, whose death is reported, had been with the Metropolitan-Vickers Electrical Company, Limited, for 37 years. Starting with the company in 1920 as a college apprentice, he joined the motor engineering department in 1922, and from 1949 was in charge of induction motor design. Mr. Spinks was particularly well known in the electrical industry through his active association with standards for electrical machines.

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CP122

Raw Material Markets

Iron and Steel

Adequate supplies of raw materials are helping the high-level production of pig-iron and imports of iron ore are on a large scale. This is to be preferred at this period of the year, as with the tonnages which are being received from home sources, stocks are being increased and continuity of production ensured. Blast-furnace coke supplies are also providing sufficient tonnages for consumption needs, with some quantities to spare for stock.

Most grades of pig-iron are now being produced at a rate in excess of home demands and in some grades tonnages could be increased. Basic pig-iron for the steelworks is sufficient for production and stocking. Imported iron is also going into stock, so that the steelworks should have good supplies to draw upon to meet any increased needs. In the foundry irons, particularly in the high-phosphorus grades, an increase in home demands would enable producers to clear a larger proportion of their makes without having to resort to stocking with consequent increased handling costs. Fair tonnages continue to be shipped overseas and are reducing the stocks on hand. These orders are being obtained against keen competition abroad.

Supply and demand of the low-phosphorus irons is on a more even keel; hematite pig-iron is in good supply and home demands are fully satisfied. Part of producers' surplus tonnages is being exported. Refined iron makers can also undertake more orders for both home and overseas consumers.

Little change is evident in the state of trade at the foundries. The call for high-duty castings is the more pronounced, so that the engineering and speciality foundries are the better employed and are calling for fairly good tonnages of pig-iron. There is very little change in the position at the light, jobbing, and textile foundries, many of which are in need of more work. Their need for the high-phosphorus pig-iron is only moderate.

Most foundries are ordering only essential quantities of raw materials; sufficient foundry coke is coming forward and ganister, limestone, and firebricks are readily available to requirements. Most foundries have enough scrap in the qualities required.

The re-rollers continue to obtain steady outputs, although the demand for small bars and light sections is only moderate, compared with the tonnages called for a few months back. There is a heavy call for reinforcing rods, and the sheet re-rollers are fairly busy.

The quantity of steel semis, now available from home sources and imports, is providing larger supplies than are at present called for by many of the re-rollers. With the decline in business for small bars and sections, stocks on hand are not being used up so quickly, particularly in the smaller-sized billets. Arisings at the steelworks of defectives and crops are difficult to dispose of, as the re-rollers are well covered for their needs in prime material.

Non-ferrous Metals

The weakness in copper persists and the past week has seen further price falls. The prime cause is over-production. Because of the shortage of copper in 1955 and the early months of 1956 prices rose to record levels, stimulating increased production in various parts of the world. The shortage of metal was more than made up and now producers are taking steps to reduce production. The general opinion seems to be that copper prices are near the bottom. On the other hand, no pronounced reversal of the trend is in sight. There are plentiful supplies to meet the current demand and many uncertainties in the situation militate against speculative buying.

Like copper consumers, users of tin show little interest in the market and the trend of prices has been lower. It is assumed that buffer pool support has been forthcoming at the £730 level.

Zinc and lead are dull markets still and there was a sharp reaction in the lead price at the news of further releases from the Government stockpile. The Board of Trade is to dispose of its remaining stocks of lead, totalling about 20,000 tons. Plans of the method and rate of disposal will not be announced until there have been discussions with trade representatives, but the disposal rate is unlikely to exceed the present rate of some 3,000 tons a month. No lead will be offered for delivery until December. Last January the Government decided to dispose of 30,000 tons of lead during a period ending in November.

Cheaper Central Heating

The British Coal Utilisation Research Association have designed a small-bore pipe, forced-circulation central-heating plant which so reduces installation and operating costs that central heating becomes economic through a greatly extended range of homes.

The plant was demonstrated in the Building Centre, Glasgow, on October 10. It comprised a conventional solid-fuel boiler feeding half-inch bore pipes, the hot water being forced through these small pipes by a new type of circulating pump which became available in Britain recently. These pumps give the necessary head using 65 w. of electricity. They have no glands or oil lubrication, and are silent.

A control device regulates the temperature of the water in accordance with the outside temperature. Control is achieved without lowering the temperature of the boiler, therefore there is no interference with the temperature of the hot-water supply to taps, while room temperatures are maintained at a pre-selected level. A system suitable for a three-bedroom house would cost under £270, that sum including plant and installation. There is almost no disturbance to the structure of the building, and redecoration is not necessary. The small pipes are inconspicuous when suitably painted. The Rheostatic Company, Limited, Slough, Bucks, are now manufacturing the plant.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

INDIA, October 30—Cupola furnace and accessories to the following specifications: Capacity, three ton per hour; coke-consumption ratio, eight : one; height (from foundation to stack top), 30 ft.; shell dia. (internal), 46 in.; lining, approximately seven inches; shell section (body), ¾ in., and stack section, ⅜ in. The cupola shall be complete in all respects. Accessories required include two spark arrestors; two skip-hoist chargers; service platform, with access ladder; mechanical-charging opening frame; two trolley ladles of welded construction, and 600-lb. capacity, and two motorized blowers of 2,000 cub. ft. per min. at 10-ounce pressure. (ESB/23476/57/ICA.)

SOUTH AFRICA, October 25—Double-stone floor-grinding machines for the Stores Department, South African Railways. (ESB/24666/57.)

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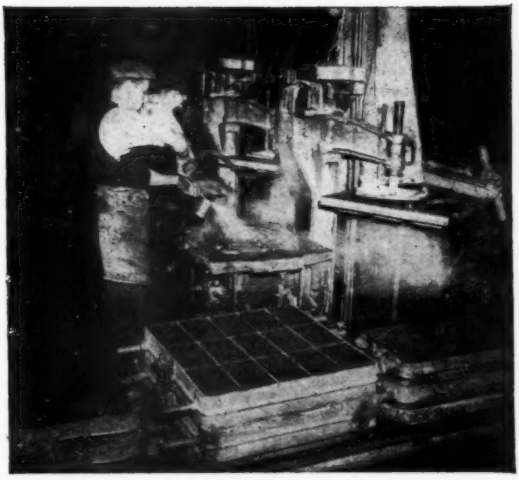

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

October 16, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S. 1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £52 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 5d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 5d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £96 0s. 0d. to £99 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. per unit; over 6 per cent. C, £94 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 33s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr.; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3d. to 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3½d. to 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3¾d. to 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3d. to 7s. 10½d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £200 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 0d. to 23s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles, N.-E. Coast, £40 6s. 6d.; joists, N.-E. Coast, £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24 g., 59 4s. 6d.; galvanized corrugated sheets, 24 g., £68 17s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £69 9s. 6d., nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £183 5s. 0d. to £183 15s. 0d.; three months, £187 10s. 0d. to £188 0s. 0d.; settlement, £183 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 10⅜d. per lb.; rods, 215s. 0d. per cwt. basis; 20 s.w.g., 248s. 3d. per cwt.

Tin.—Cash, £731 0s. 0d. to £731 10s. 0d.; three months, £727 10s. 0d. to £728 0s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—Second half October, £85 0s. 0d. to £85 10s. 0d.; second half January, £85 10s. 0d. to £85 15s. 0d.

Zinc.—Second half October, £68 10s. 0d. to £68 12s. 6d.; second half January, £68 10s. 0d. to £68 12s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £102 5s. 0d.; rolled zinc (boiler plates), all English destinations, £100 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £85.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 6⅝d. per lb.; sheets to 10 w.g., 165s. 0d. per cwt.; wire, 2s. 4½d.; rolled metal, 165s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £137; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £187; HTB2 (38 tons), — ; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £169; LG3 (86/7/5/2), £179; G1 (88/10/2/½), £240; (88/10/2/1), £228.

Phosphor Bronze.—BS1400, PB1 (AID released), £252 per ton.

Phosphor Bronze Strip, etc.—Strip, 241s. 0d. per cwt.; sheets to 10 w.g., — per cwt.; wire, 3s. 6⅞d. per lb.; rods, 2s. 10⅜d.; tubes, 2s. 10¾d.; chill cast bars: solids 2s. 10½d., cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 5½d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 10½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 9½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £75 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, — ; AB2, £252.

* Average 68-70 per cent.